GAS JOURNAL, OCT. 25, 1944
VOL. 244 96th YEAR No. 4249

EDITORIAL NOTES

INSTITUTE OF FUEL

THE very large number—over 550—of men distinguished in public life and in the varied fields of fuel technology who were present at the Annual Luncheon of the Institute of Fuel provided eloquent testimony to the popular attraction of this enthusiastic organization and compliment to the President, Dr. E. W. Smith, who continues in office for a further year. The Institute grows in strength, stature, and influence, and the sphere and scope of its activities widen. When it was brought into being 17 years ago the membership was 420; it is now nearing the 2,000 mark, a figure it will reach before the end of the year. It has done and is doing excellent work, and there is every indication that in the future its work will be both more widespread and more fruitful. Throughout it has had a succession of most eminent Presidents, and has been extremely fortunate in its able, zealous, and enthusiastic Secretary, Mr. P. C. Pope.

The field of fuel technology is vast, covering preparation, distribution and utilization, and embracing coal, gas, oil, and electricity; and it is the broad basis of the Institute which strikes us as being its most attractive feature, and as giving the body its main purpose. It provides a remarkable and, we think, a unique platform for discussion of fuel problems in a more general way than would otherwise be practicable, enabling the constituent fuel interests to get together and gain a composite picture. Many of the conferences it has organized have been outside the province of the professional bodies of the separate industries concerned, and we could instance several so-called symposia which have had considerable practical use in making clear the views and needs of sectional interests in the fuel fields —views and needs often conflicting—*vis-à-vis* the fuel problem as a whole.

The past year has been one of much progress in the Institute's affairs, an important step being the reorganization of the District Sections, which now have representation on the Council; and, as Dr. Smith said in his Presidential Address—an abstract of which we give on later pages of this issue of the "JOURNAL"—they will act as a lever or catalyst among their fuel brethren and, apart from their own immediate responsibilities, give every assistance to the local representative of the Ministries and other institutions whenever and wherever such assistance is needed. There are now seven very active Sections, and we know that Dr. Smith, too, has been very active in stimulating and encouraging their work.

A further move during the year has been the creation of a guarantee fund of £5,000 a year to finance the activities of the Sections, pay for an enlarged headquarters staff, and cover expenses which will follow the introduction of the education scheme which marked yet another move during the year. We outlined the aims of this scheme in the "JOURNAL" of Sept. 6 last; and if it enhances the status of the Institute without detracting from the catholicity of its membership and, indeed, its membership strength and the broad purpose which we have already discussed, so and good. We may well ask, however, What is a fuel technologist? One covering expertly the whole fuel field of coal, gas, oil, electricity, and, of course, solid smokeless fuels? To expect such is, to say the least, to expect much. Or is a fuel technologist someone with a nodding acquaintance of the innumerable mixed problems involved? As fuel technique develops, so does specialization become more imperative. The professional bodies of the different interests—coal, gas, oil, and electricity—have their own specialized education and examination systems in operation. We suppose that for the most part those who are attracted to membership of the Institute of Fuel and are keen to take an active part in its proceedings have qualified in their particular spheres in the fuel field, and it is perhaps a little difficult to arrive at any conclusion regarding the probable or possible benefits or otherwise of the Institute of Fuel's education plan—to what extent it strengthens, or to what extent it may impose a limit on the Institute's work, to what extent rigidity may displace that very flexibility which to our mind constitutes such a valuable asset of the Institute, to what extent the Institute desires to become "professional," as it were, amid the other specialized and essentially professional institutions.

At the annual luncheon Mr. Pope said the Institute was really an information service, that it came in between the research organizations and industry, and was one of the means of translating some of the research work into practical application. As a matter of fact, one of the objects of the Institute as set out in its Memorandum of Association is the setting-up of an information bureau. And here again we are not quite clear in our mind about the way such a bureau—and we have no quarrel with the idea of information bureaux—intends to tackle the problem of fuel enquiry. Is the bureau to be a disseminator of information from within, or does it intend to combine such a service with the role of "You have the query; we have the answer"? Does it wish to become an intermediary between the outside world, including prominently various Government departments, and the different fuel interests which are constituent parts of the Institute, or does it rather seek the function of librarian-cum-publisher? To what extent, if any, does it desire to be a universal fuel-aunt? In what measure could it be approached for advice on a matter relating, for example, to gas manufacture or utilization? There does seem to be a case for more precise definition.

Leaving the answers to these few questions to those who have a more intimate knowledge of the Institute than we ourselves would profess to possess, we turn for a moment to the Presidential Address of Dr. Smith. He spoke of the Gas Industry to an audience not just composed of gas men, but representative of fuel interests generally, and as such his Address appealed to us very much indeed. The President has a long, an intimate, and a most varied association with the Gas Industry's work during the past thirty years and more. His Address—a vivid and lucid picture of how the Industry has tackled its technical problems—was highly appropriate at a meeting of the kind, and must have proved a research eye-opener to many. Young in thought, if of mature years, the Industry was among the first to grasp the need for continuous research, and Dr. Smith was able to speak as one in touch with early research as a member of the staff of an enlightened gas undertaking, later with his finger on the pulse of development as the technical director of a foremost firm of gas plant contractors, and throughout in contact with the research organizations supported by the Industry. The Address was, in fact, a broad statement for a gathering having a wide range of interests, and as such was most fitting. Members of the Gas Industry do, or should, know the story; and it is a record of enterprise of which the Industry has no occasion to be ashamed. Dr. Smith did indeed justify his contention that the Industry is well in the van of those industries which have made major technical advances in recent years, and his concluding sentences were full of point. "The future of the Industry," he said, "depends first on the extent to which its technical men maintain its technical position, and, secondly, on the way in which the Industry as a whole, as distinct from the undertakings themselves, is administered. Great things are expected from the Committee of Enquiry set up by the Ministry of Fuel and Power, but whatever recommendations may be made, it will still rest with the rank and file of the Industry—*viz.*, the Industry itself—to make the major contribution to its continued success."

The other item in the programme of the Institute's annual meeting was the Melchett Lecture delivered by Dr. J. G. King, Director of the Gas Research Board, who, under the title "The

Pattern of Fuel Research," postulated the existence of a pattern in organized research for which plans must be made in advance. The subjects he chose to illustrate his conception were hydrogenation, the gasification of coal, and coal constitution, all of which subjects lie within his own experience, and with the organized research work on which he has been associated. The pattern, he maintained, can in no sense be rigid; it should be subject to frequent review to eliminate unnecessary or unprofitable work and to reassemble the research forces for direction against new objectives. There should be room in the pattern for the work of the individualist, whose abilities will develop to the full only if he is allowed to work in his own way. His position will never be anomalous, however, since his discoveries may well, at a suitable stage, become team work, and thus take their place as part of the organized pattern. Finally, the existence of a pattern does not mean that all the work shall be done in one place or by one organization. On the contrary, if the pattern is there, it must serve as one means of promoting that true collaboration in research which alone will avoid the wastage of effort caused by undue overlapping. An abstract of the Lecture will be found on later pages.

Personal

Sir DAVID MILNE-WATSON, Bart., has, for reasons of health, given up the appointment of Managing Director of the Gas Light and Coke Company, which he has held since 1916. The Directors, in accepting Sir David Milne-Watson's decision with regret, have put on record their appreciation of his long service in his capacity of Managing Director. Mr. A. E. SYLVESTER remains as sole Managing Director.

* * *

After 40 years' service with the Tredegar Council, Mr. D. WALTER DAVIES has retired. He served under 81 Councillors. Mr. Davies was the Council's Gas and Water Engineer and Manager from 1905 to 1944, and was also for many years Electrical Engineer and Chief Officer of the Fire Brigade. At a recent meeting, when a photograph of Mr. Davies was hung on the wall of the Council Chamber, the Chairman of the Council (Councillor James Travenen, J.P.) said they were recognizing long and efficient service to the Authority. No photograph deserved to be placed in the Council Chamber more than that of Mr. Davies. Councillor D. W. Bowen and Councillor Oliver Jones, among others, including Mr. Davies's successor, Mr. S. L. Filer, paid high tribute to the work of Mr. Davies.

* * *

Mr. GEORGE W. ALLEN, previously Secretary-Treasurer of the Canadian Gas Association, is now to be titled Executive Secretary and Treasurer. The offices of the Association are at 7, Astley Avenue, Toronto, 5.

Obituary

The death has occurred of Mr. D. T. LIVESEY, of Burgess Hill. He had completed 50 years' service with the East Grinstead Gas and Water Company, having been appointed Engineer and Manager of the Gas-Works in 1894, and later having charge of the whole Undertaking. He retired in 1928, and ultimately became Managing Director and Deputy-Chairman. His son, Mr. D. T. Livesey, is Engineer and General Manager to the Doncaster Gas Department.

* * *

The death has occurred of Mr. THOMAS SCOTT, Works Superintendent of the Granton Gas-Works of Edinburgh Corporation. Mr. Scott entered the service of the Edinburgh Gas Department in 1908 after receiving his early training and experience with local engineering firms, and became Works Superintendent in 1930. Since then the works have been greatly extended and modernized, and under his supervision have maintained their place as one of the foremost manufacturing stations in the country. Deceased took a deep interest in the welfare of the employees, and was for nine years President of the Works Bowling Club.

* * *

The death occurred at Woldingham, Surrey, on Oct. 18 of Mr. A. GORDON ROBBINS, Chairman of Benn Brothers, Ltd., publishers of the *Gas World* and other periodicals. Mr. Robbins, who was 61, was Treasurer, Vice-President, and Member of the Newspaper Press Fund, and was President of the Institute of Journalists in 1942–43.

* * *

Frederick T. A. Blencowe

With the passing last Friday of FRED BLENCOWE there ended a lifetime of service to the Gas Industry. Born on October 10, 1881, he joined the "JOURNAL" staff as a boy straight from school and missed by only some two years what had long been his cherished ambition—the completion of a half-century with the firm. After a few years' general apprenticeship he became Walter King's Secretary, but those were days when specialization was limited and all hands to the pump on press day, so that there were few jobs in an editorial office in which at one time or another he had not had experience. In this capacity many of the older generation of gas engineers will remember him, but later, on the formation of the Company, he became Publishing Manager, and his contacts were largely in the newspaper and book trading side of the business. In those days, however, the high light of Blencowe's year was undoubtedly the British Industries Fair, at which from its opening hour to its close he stood staunchly in charge of the "JOURNAL" stand. He was a faithful " gas man " if ever there was one, and this annual week among the personnel and in the very atmosphere of the Industry always served still further to increase his enthusiasm.

We of the later generation will miss "Blenc" as one misses something which seems always to have been there. We believe that Walter King inspired in him such genuine loyalty as it is seldom one's fortune to meet, and that he transferred it, with a faithfulness and integrity which it would have been impossible ever to doubt, to Walter King, Ltd., and to those whose endeavour it has been to carry on the tradition of the "JOURNAL." We shall miss him, too, as a never-failing storehouse of recollections and invaluable memorized data which extend far back beyond existing records, and most of all when the time comes for our return to 11, Bolt Court, of the very structure of which he almost seemed a part.

After a lifetime singularly free from even the commonest ailments, Blencowe's health began to fail him towards the end of last year, but it was only with the greatest difficulty that we were able to persuade him in the spring to give thought to himself as well as to the job for which he had lived. It would perhaps have done him good could he have witnessed the willingness with which his colleagues assumed his various tasks in the hope that rest would restore him to health. But he was destined never to return. After treatment had failed, he underwent a serious internal operation in St. Helier Hospital, Carshalton, last month and, though it brought him a few weeks' happiness in his confidence that it would enable him before long to resume his normal activities, he died a few days after his 63rd birthday. He leaves a widow and a young daughter.

W. R. K.

Letters to the Editor

Coke and Cost of Gas Production

DEAR SIR,—The following is an extract from the Presidential Address of Dr. E. W. Smith to the Institute of Fuel:

> "Recently, there has been a good deal of controversy as to whether the Gas Industry should continue to produce coke or whether it should adapt its manufacturing methods to the supply of gaseous fuel only.
>
> "The present position may be summarized as follows:
>
> "(1) In producing coke, the Gas Industry is placing at the disposal of the community bulk supplies of a solid smokeless fuel at a price which makes it, in many instances, the cheapest form of fuel to use.
>
> "(2) The credit for coke at the gas-works (after allowing for preparation, &c.) is sufficient to reduce the cost of coal per therm of gas by roughly one half. It is a matter of simple arithmetic to show that the coke would have to be turned into gas with a yield at least twice that obtained at present per ton of coal if the cost of coal per therm is to remain at its present level.
>
> "(3) It has not yet been proved, in my opinion, that there is any practical process of doing this at a satisfactory cost which will give a gas similar in calorific value, specific gravity, and other characteristics to the town gas of to-day.
>
> "In face of these facts coke should be looked on as one of the most valuable assets of the Gas Industry."

The foregoing raises in my mind the following questions:

(1)*a*. What is the cost for coal only to produce one ton of gas coke by the present process?—if simpler, include tar with the coke.

b. What is the gross selling price of one ton of coke?

c. What is the net selling price?

(2)*a*. How is this credit arrived at which reduces the cost of coal per therm by one half? Let us have the figures concerned, please.

b. "If the cost of coal per therm is to remain at its present level." This remark appears to intimate that if the cost of coal varies, the proportional costs of a gas therm will be affected. Is such an intimation seriously made?

(3)*a*. "It has not yet been proved that there is any practical process of doing this." To what does "this" refer?

(4)*a*. "In face of these facts." What facts?

I regret I am unable at present to accredit these statements as facts—any one of them—and I hope Dr. Smith will help me to understand the matters to which I refer. I do recognize their importance.

Yours faithfully,

Oct. 14, 1944. GEORGE HELPS.

P.S.—Even if Dr. Smith's figures were correct and 67½ gas therms were actually produced from 6½ cwt. of coal, the processing of 3 tons of coal would be necessary to produce 202½ gas therms. By the proposed process 202½ therms are producible from one ton of coal. These figures show that two tons of coal out of three tons are being uselessly processed so far as gas production is concerned.—G.H.

Rehabilitation

DEAR SIR,—Your ever-welcome "JOURNAL" has warmed my exiled heart with many items of good news, but I have so far looked in vain for very heartening news of rehabilitating the thousands of Gas Industry employees on active service.

Speaking, I think, for most of us, we gratefully look to our employers to reinstate us on demobilization—but to what? Inferior, equal, or superior positions to those we left?

Absence up to five years from our jobs leaves us sadly lacking in experience, and in many cases expecting a larger salary in justification of increased age and personal responsibilities.

Some have left I.G.E. or other studies incomplete, all have lost opportunities to some degree. All of us are eager to do our utmost towards the Industry's prosperity; our eagerness can best be utilized only if a co-ordinated scheme is inaugurated to train ex-Service employees of all departments to competence and new confidence in their proposed occupation.

In fairness to employer and employee the Industry should have a complete rehabilitation plan. I hope I shall not peruse the "JOURNAL" in vain much longer.

Yours faithfully,
C.M.F. LIEUT. "DOUBTING THERMOS."
Oct. 11, 1944.

[The matter referred to by our correspondent was discussed in the editorial columns of the "JOURNAL" last week.—ED. "G.J."]

London and Counties Coke Association

The Eleventh Annual General Meeting of the London and Counties Coke Association was held at Grosvenor House, London, on Oct. 16, the President, Mr. FRANK H. JONES, M.Inst.C.E., presiding, On the proposition of Mr. C. H. CHESTER, seconded by Mr. W. PHILLIPS, Mr. Jones was unanimously re-elected President for the ensuing year. In accepting office, Mr. JONES said that while he greatly appreciated the honour, he would advise the Association not to keep the same President for too many years. He then formally moved the adoption of the Annual Report and Accounts.

Colonel H. C. SMITH, Chairman, in seconding, said that in addition to the ordinary work of the Association, much time was spent on other services, a considerable amount of work being incurred in connexion with the importation of coke. There was also much detailed work in connexion with the collection and disposal of the levy which had made possible the smooth working of the coke importation scheme. Secretarial work on behalf of the National Federation of Gas Coke Associations had also increased. In the year under review there had been two increases in the price of coal, one of 3s. per ton from Feb. 1, and one of 4s. per ton from Aug. 1, each of which was followed by a similar increase in the price of coke, but these increases did not by any means represent the total extra cost which had to be incurred by coke producers. In many cases coal was now delivered from collieries other than those which producers normally used and was carried by inconvenient and more expensive methods of transport. The 7s. increase in the pithead price of coal by no means represented the total increase in the cost delivered to gas-works, and it was unfortunate that as the price of coal was increased the output from the collieries was reduced.

The general coke stock position was dealt with in the annual report. At this time last year stocks were high, and in some cases embarrassingly so. He had said at the time that although these stocks caused embarrassment in some places, from the national point of view they were good stocks, and he thought it would be agreed that the demand for these stocks had confirmed that opinion. The reduction of stocks due both to an increase in the amount of water gas manufactured and also to an increased demand for coke had necessitated an increase in the importation of coke into the area. The levy scheme which permitted this importation to take place while regulating the price at which coke was sold had proved again to be of great value. Since the levy was started in 1940 over a million tons of coke had been moved under the scheme. He referred again to the necessity for doing everything possible to improve the quality of coke by giving attention to the question of quenching and sizing. Until they had some freedom in selecting and purchasing the coals they required, they were at a great disadvantage in supplying the type and quality of coke required by their customers. The markets for coke after the war would be more specialized than they were before the war, and it would be more than ever necessary for them to supply fuel prepared for these specialized markets.

The Coke Distributors' Branch continued to function as a most important part of the organization. They were constantly in touch with the members of that branch, and they got every possible assistance from Mr. John Charrington and Mr. Jack Hopper, the Chairman and Vice-Chairman of the Branch. Mr. Charrington and his colleagues had taken steps to interest distributors in other parts of the country in the formation of Coke Distributors' Branches, and it was hoped in due course every District Association would have its Coke Distributors' Branch represented in a National Federation of Coke Distributors' Branches.

The Committee had always held the view that coke rationing was impracticable, but the stock position was such that some effort must be made to secure an equitable distribution of such coke as would be available during the coming winter. The Minister of Fuel and Power had decided that programming would be necessary, and all members of the Association, both producers and distributors, had been asked to provide information of their estimated production and details of their sales of coke in order that a programming scheme might be evolved. When the information supplied by members was collated a serious shortage was disclosed of coke in the area of the Association in the current year, this shortage depending, of course, to a large extent on the war situation. As the Ministry had declared their policy to be an equitable distribution of coke throughout the country, this shortage meant that more coke would have to be imported into the area than would have been the case had programming not come into force.

Referring to the progress of the National Federation of Gas Coke Associations and the establishment of the National Technical Committee, Colonel Smith said they had been only too pleased to place at the disposal of the National Committee all the technical information accumulated during the past 13 years. The National Federation had prepared and submitted a memorandum of evidence to the Committee of Enquiry into the Gas Industry.

The technical work of the Association had been largely concerned with the design of coke-burning appliances for post-war houses. Appliance makers generally had accepted the recommendations made by the Technical Committee. Most of the manufacturers had already produced prototypes of new appliances, some of which had been tested and approved for production as soon as possible. The Government had had several houses of different designs fabricated as prototypes, both for the intermediate period of temporary housing and for the large scale permanent development, and in several of them appliances had been installed which were either to new designs approved by the Association or were existing types already on their approved lists. In all housing projects sponsored by the Government solid fuel appeared to have retained a substantial part of both the heating and the hot water load, and while the Ministries concerned were not specifying the type of solid fuels to be used, they were providing appliances which were essentially suitable for burning smokeless fuels.

Technical representation had been fully maintained on external bodies with which the business of the Association was concerned, and in certain directions, particularly in regard to the British Standards Institution, the work had actually been extended. Calls made by the Ministry of Fuel and Power upon the Association had not diminished, and they were actively concerned with those committees of the Ministry dealing with fuel efficiency as well as technical education. They were also represented on committees dealing with heating and ventilating for post-war development under the auspices of the Ministry of Works and Planning.

Referring to future coke policy, Colonel Smith spoke of the many discussions taking place on the merits and demerits of complete gasification as against the production of gas and coke, and said it might be that in due course experimental work now being carried out would result in systems of complete gasification which would relieve them of the necessity of marketing coke, but if such a system of carbonization or gas production were to be placed before the Industry to-morrow, it would be years before any substantial number of existing carbonizing plants were replaced by complete gasification plants. In the meantime these older plants would have to make coke, and it was therefore obvious that from whatever angle they looked at the future of carbonizing, as an Industry for some years they would have to produce and sell coke. It was therefore essential that they should prepare their coke as any manufacturer prepared his products for sale in a competitive market, and that they should build up their selling organizations on the same lines.

In conclusion, Colonel Smith paid tribute to the services of the staff, and also to Colonel Flowers, who was responsible for conducting the detail work in connexion with the Distributors' Branch.

The report and accounts were then adopted.

Miss C. A. WOOSTER, General Secretary, reported the county nominations for the composition of the Central Committee for 1944–45.

Messrs. Cash, Stone & Co. were reappointed Auditors for the ensuing year.

Luncheon Speeches

Major LLOYD GEORGE, Minister of Fuel and Power, and Mr. R. W. FOOT, first Chairman of the Association, and now Chairman of the Mining Association of Great Britain, were the principal guests at the annual luncheon which preceded the meeting.

Mr. R. W. FOOT proposed the toast of "The London and Counties Coke Association." Founded on trust, confidence, and friendship, the Association had, he said, not been unhelpful during five years of war, and would be of the greatest value not only to the Industry but to His Majesty's Government in helping to shape the country's post-war business organization.

The PRESIDENT, in a brief reply, acknowledged that the present position of the Association was due in large measure to the foundations laid 13 years ago by Mr. Foot.

Colonel H. C. SMITH, Executive Chairman, proposed the toast of "The Guests," and extended a special welcome to Major Lloyd George, Mr. Foot, and Mr. S. E. Whitehead, President of The Institution of

Gas Engineers. He said that whatever plans the Industry might have for the future depended almost entirely on an adequate supply of the correct types and blends of coal at reasonable prices. None of them desired to see miners receive anything but a fair wage for their work, but they were appalled at the increases which had occurred in the cost of coal during the five years of war, and at the reduction in output which had followed each increase in wages. The supply of adequate quantities of suitable coal at the right price was fundamental not only to the successful progress of their own Industry, but of every industry in the country.

Major LLOYD GEORGE, responding, said that since last March, when there were no restrictions on coke, they had had to go into reverse. They now had restrictions on domestic coke, and industrial supplies had to be programmed. To the superficial observer such changes might appear to be inveterate shilly-shallying, but by informed critics they would be regarded as instances of statesmanlike flexibility. Such changes had to take place from time to time. Circumstances changed very quickly in wartime, and it was a tremendous help to the Ministry that they were able to produce coke to the extent they did last winter. Coke and house coal had been in short supply in the Association's area during the summer, and the coke levy scheme had been a tremendous help in getting supplies into those areas where they were most needed. As Minister he appreciated all that the Association was doing, and he was glad they were devoting attention to post-war technical developments. One of the purposes of the Ministry was to see that our greatest national asset, coal, was utilized to the best advantage. No one in this country would begrudge the miner a reasonable wage for his arduous and dangerous work, but if his wage and standard of life were to be assured, the cost of the product must not become excessive. There were two ways of preventing that, one by more efficient extraction of the raw material itself, and the other by more efficient use of it by all the millions who used it in this country. One of the things the war had taught us was that it was not in the national interest to waste this precious raw material that we still had in great abundance. He thought coke had a great future. It had been extremely useful during the war, and he was glad to see that the Industry was already manufacturing new appliances for its more efficient use. That, in turn, had an important bearing on the important question of smoke abatement. No one would deny that there were tremendous problems still ahead. While they were sometimes appalled at their dimensions, he thought they could take courage in the contemplation of the great opportunities that they presented. If they seized those opportunities, he believed they would emerge from their great trials stronger than they were before they started.

The toast of the President was briefly proposed by Mr. S. E. WHITEHEAD, and responded to by the PRESIDENT.

Diary

Oct. 27.—Manchester District Association of Gas Engineers: Autumn General Meeting.
Oct. 27.—London and Southern District Junior Gas Association: Gas Industry House, 6.30 p.m. Presidential Address of R. F. Twist.
Oct. 31.—B.G.F. Domestic Heat Services Committee: Gas Industry House., 2.30 p.m.
Nov. 4.—Scottish Junior Gas Association (Eastern District): Visit to Galashiels Gas-Works.
Nov. 4.—Yorkshire Junior Gas Association: Meeting in Leeds. Paper by V. J. J. Siddons.
Nov. 7.—Southern Association of Gas Engineers and Managers (Eastern District): Films, "Boiler House Practice" and "Steam Utilization"; discussion opened by Mr. W. H. Gamble; Gas Industry House, 2.30 p.m.
Nov. 14.—N.G.C. Central Executive Board: Gas Industry House, 1.30 p.m.
Nov. 14.—Council of the British Gas Federation: Gas Industry House, 3.30 p.m.

Dover's Shelling Ordeal

During the terror shelling of Dover by German long range guns last month hundreds of shells fell in the borough, and though not all were in built-up areas, the damage was enormous. We are indebted to the *Daily Express* for the following details: "Seventeen gas mains varying from 3 in. to 14 in. were fractured and numerous services had to be cut off to stop leakages. The gas supply was continued during the whole period, but at times, for a short while, owing to the damage to mains, it was at a reduced pressure. The employees carried out their duties with great willingness, whether during shelling or in lulls, and repairs were quickly done. Great assistance was given by the Rochester, Chatham, and Gillingham, East Kent, Whitstable, Deal, and Canterbury gas and water undertakings."

The Directors of the Montevideo Gas and Dry Dock Company, Ltd., announce a dividend of 2% free of tax on Ordinary Capital, comprising 1% balance for 1943 (making 4% for the year 1943), and 1% on account of the year to December, 1944.

"Brides' Classes" at Dudley

For some little time now the Dudley, Brierley Hill, and District Gas Company has been running a series of instruction classes in cookery for young people which have been called the "Brides' Class." These have been organized by Mrs. G. Tomlinson, M.C.A., who is in charge of the Company's Home Service Bureau. The intention is to demonstrate the fundamental operations of cooking, while at the same time giving information of the way of dealing with wartime difficulties and still providing a nutritious diet. The Classes, which are held in the evenings at both the Dudley and Brierley Hill Showrooms (the photograph shows the Dudley class), are alternately demonstrations and practical work by those attending so that they themselves can try their own hands carrying out the cooking instructions. They have proved extremely popular. They were started in the beginning as a trial for a period of six weeks, but at the request of those attending have been continued and seem likely to be continued indefinitely. It might be called "learning cookery without tears." Those attending the cookery demonstrations of the Company have always been anxious to help War Charities, and much assistance has been given to the Red Cross. The "Brides' Classes" at Dudley and Brierley Hill have chosen together to assist the Merchant Navy, and are sending an "Ocean Library" through the Merchant Navy Comforts Fund.

A Meeting of the Cornish Gas Association was held at Truro on Oct. 11, when Mr. R. J. Gregg, Sales Manager of Ascot Gas Water Heaters, Ltd., gave an Address.

Mr. J. C. Cotterill (St. Austell) congratulated Mr. Gregg on his Address. Mr. T. J. Greenwood (President, Bodmin) said that in Cornwall they had encouraged attendance of sales staffs at meetings of the Cornish Gas Salesmen's Circle. Before the war a strong and active body was in existence in Cornwall. Fares and expenses were always paid. Mr. R. J. Williams (Truro) remarked that the time would soon come when the Gas Industry might find difficulty in obtaining suitable young recruits. He knew of local engineering firms who had no difficulty in obtaining a good type of entrant, chiefly owing to the fact that those firms gave considerable attention to welfare, educational facilities, and working conditions.

The Directors of Associated Gas and Water Undertakings, Limited have declared an interim dividend on the Ordinary Stock of 2½% actual, less tax; and an interim dividend on the Deferred Stock of 3% actual, less tax, on account of the year ending March 31, 1945. (Both dividends are the same as paid last year.)

An Excellent Method of emphasizing the importance of efficiency in the usage of gas was introduced by representatives of the Cambridge University and Town Gas Light Company at a Domestic Fuel Economy Conference held in the town recently for members of the W.V.S., and organized by the Ministry of Fuel and Power. Mr. H. R. Stanley gave a talk covering many aspects of gas usage, including hints on the avoidance of wasteful consumption. He was supported by Mr. C. Hunt, who, with two blackboards at his disposal, supplemented the speaker's remarks with a series of sketches, diagrams, and figures, which proved a delight to the audience while providing much sound information. It was felt that, by appealing to the eye as well as the ear, the Gas Industry's fuel efficiency message had been presented more effectively than in the usual orthodox manner.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in the "Journal" should not be taken as an indication that they are necessarily available for export.

Technical Developments in the Gas Industry*

By Dr. E. W. SMITH, C.B.E., F.R.I.C., M.I.Chem.E.

DURING the year three important developments have taken place within the Institute of Fuel. The most important is that there are now seven very active Sections. The second is that admission to the Institute now demands adequate technical qualifications and experience. The third is the creation of a guarantee fund of £5,000 a year to finance the activities of the Sections, pay for an enlarged headquarters staff, and cover the expenses which will follow the introduction of the education scheme, as these cannot be met out of the individual subscriptions of our members. We have had much encouragement from the ready response that has been made already by a number of industries—more than half the sum required having been promised. And it would seem that within a few weeks, when the councils of the trade associations have met, the whole of the money will be forthcoming.

I wish to draw your attention to the very real and almost revolutionary advances that have been made on the technical side of the Gas Industry.

Technical progress in the Gas Industry is derived from three sources:

1. The gas undertakings who manufacture, supply, and sell gas and by-products;
2. The contractors and manufacturers who develop and supply the necessary plant and apparatus for the manufacture, distribution, and utilization of gas and coke to the gas undertakings; and—
3. The research organizations supported by the Industry—as, for example, the Joint Research Committee at Leeds University, now co-ordinated with the Gas Research Board.

It has been my good fortune to have been associated with each of these sources of progress. After a period spent upon research work for the Gas Industry at Leeds University, I was attached to the staff of one of our leading municipal gas undertakings for 10 years, and then for nearly a quarter of a century I was responsible for the technical direction of a firm which has been privileged to play a not inconsiderable part in providing the Gas Industry with its present-day manufacturing plant.

Looking back, one can see that the period 1907 to 1911 ushered in a most important stage in its development. The Industry was about a century old. Through the skill and determination of many devoted servants it had reached a position where it already formed an essential part of our national life. As the chief supplier of artificial lighting, its position had been scarcely challenged. The advantages of gas for domestic cooking and heating were enjoyed by an increasing section of the public. Industry, in general, was becoming increasingly aware of the benefits which were to be obtained by the use of gas in place of solid fuel.

The period mentioned was, however, a time of flux, for new and revolutionary systems of gas manufacture were in process of development and new outlets for gas were available which demanded greater technical resources than were then available. It is to the credit of the Gas Industry that in order to take advantage of these opportunities joint efforts were begun with appropriate authorities in the scientific investigation of many of the problems involved.

The Gas Industry Then and Now

At the beginning of this century gas was produced to conform with illuminating power standards. This requirement dictated the type of gas-making plant employed, the kind of coal used, and the conditions of operation. Horizontal retorts were in general use, though for some years inclined retorts were much in favour. Rich gas-making coals were selected, and in many instances a proportion of cannel coal was added in order to maintain the required illuminating power of the gas. In many of the larger works, heavily carburetted water-gas was produced at peak load periods. Moderate carbonizing temperatures were employed, the average make of gas being about 10,000 cu.ft. per ton of coal with an illuminating power of, say, 16 candles per cu.ft. (calorific value about 600 B.Th.U./cu.ft.). As the richest gas-making coas became more difficult to obtain, various expedients for maintaining the illuminating power and the required standard, such as adding oil gas or carburetting the gas with benzole, were sometimes employed.

The gas engineer's life in the later part of the first decade of the century was one long struggle to maintain the production of high illuminating power gas from poorer coals. And this in spite of the fact that, with the development of incandescent lighting, high illuminating power was quite unnecessary, and it was equally unnecessary when the gas was used for domestic cooking and heating, and for industrial purposes. The newly-developed vertical systems of carbonization had been found to be capable of producing a gas with a satisfactory calorific value, but with an illuminating power below the statutory standard, and as a consequence gas engineers were hesitant to adopt them. To meet this situation Parliament legalized the use for testing purposes of an alternative form of test burner which with a given gas produced an illuminating power some two candles higher than that obtained with the then standard burner.

The conditions arising during the last war then forced a further change. The general shortage of coal made it necessary for gas engineers to obtain the maximum possible thermal yield of gas irrespective of its illuminating power and the imperative demand for toluole, which was obtained by washing coal gas and also reduced the illuminating power, but the gas so produced and washed still had a satisfactory calorific value.

The experience thus gained made it possible, when the war ended, for the Gas Industry to seek the necessary power from Parliament to adopt a calorific value standard in place of illuminating power. This resulted in the Gas Regulation Act of 1920, which set up the requisite standards with appropriate safeguards for the consumers. This was, indeed, a "Magna Charta" for the Industry, and its influence on subsequent developments has been profound.

It is of interest to note that while the limits of the range of calorific values adopted by gas undertakings vary from 600 to 200 B.Th.U./cu.ft., by far the greatest proportion lie between 500 and 450 B.Th.U./cu.ft.

A brief survey of the Gas Industry to-day shows that about 76% of the gas made is obtained from the carbonization of coal in four types of carbonizing plant—horizontals, intermittent and continuous verticals, and coke ovens—each of which has its most suitable field of action; about 10% of the gas is water-gas (mainly carburetted), which is used for dilution purposes and to meet peak loads; about 12% is purchased from coke oven plants, while the balance (about 2%) is obtained from various gasification processes.

One of the most interesting differences between now and the earlier part of the century is that whereas formerly all the water gas was made in separate water-gas plants, to-day a considerable proportion of water gas is produced during carbonization by steaming intermittent and continuous vertical retorts. The general level of efficiency of gas production has been raised, and there has been an increase in the yields of tar and ammonia per ton of coal. The vertical systems of carbonization with their increased output per unit of ground space has enabled congested works to meet increased demands for gas.

It must not be overlooked, however, that the Gas Industry provides in the form of coke over 60% of the solid smokeless fuel available for the country (outside the iron and steel industry). The cokes produced by the four different systems of carbonizing plant enumerated above have different properties which suit different purposes. I have no doubt that in the future there is likely to be an increased demand for a solid smokeless fuel, and by continuing its efforts to improve the quality of gas coke and by attention to marketing the Gas Industry can play an important role in satisfying this demand.

During the period 1918 to 1938 the technique of gas manufacture underwent a complete revolution. Two facts especially contributed to this revolution—the substitution of the calorific value in place of the illuminating power standard for gas supply and the introduction of improved refractory materials. From this time the average calorific value of gas supplied progressively fell, and the make per ton of gas was increased by admixture with blue water gas made either by "steaming" the carbonized charge or in separate generators.

While horizontal retorts continued to be improved in design, performance, and labour cost, new forms of carbonizing plant were developed, notably continuous vertical retorts and intermittent vertical chambers. For very large installations coke ovens found some supporters. Increased demand for water gas gave rise to major advances and improvements in plant design. All of which led to there being available a wide choice between various forms of carbonizing and gas-making plants.

At the same time the demands for an increased gas yield per ton of coal, with a lower fuel consumption, less labour, and improved working conditions, and a larger output of gas per unit of ground space, necessitated the concentrated attention of plant designers, whose work became more and more dependent upon a specialized knowledge of civil, structural, mechanical, and chemical engineering, and of chemistry, physics, and metallurgy.

Laboratory Investigations on Coal and Coke

In order to select the form of carbonizing plant suitable for any project, the plant designer needs to know all he can about the coal to be carbonized. During the past 25 years a number of tests have been evolved, adapted or adopted in the Woodall-Duckham Laboratories for the examination of the gas-making and coking properties of coal and for the study of the behaviour of coal during carbonization. These methods have provided a reliable small-scale means of forecasting the behaviour of a coal under a variety of carbonizing conditions and the yields and quality of the products obtainable.

Probably the most interesting test developed is also the simplest—namely, the crucible swelling test—which has since been adopted as a British Standard Test (B.S.S. 804).

Quite apart from its value as a simple "tell-tale" in connexion with

* From the Presidential Address to the Institute of Fuel.

continuous vertical retort practice, this swelling test is a simple guide to coke quality when blending coals for coking purposes. Broadly speaking, accumulated experience with this test may be summarized as follows:

For Continuous Vertical Retorts.—Coals with swelling numbers ranging from 1 to 7 offer no difficulty in carbonization, irrespective of the rate of heating, and they can be subjected to steaming as required. Coals with numbers 8 and 9 are more sensitive to rate of heating and less reactive to steaming. Coals with swelling numbers up to 3 generally produce a coke smaller in size than the original coal. As the swelling number rises from 3 to 9 the percentage of breeze is reduced.

For Intermittent Vertical Chambers and Coke Ovens.—It is questionable whether a coherent coke could be obtained with a coal having a swelling number less than 2 to 2½. For a satisfactory coke a swelling number of at least 4½ to 5 is desirable. No difficulty is experienced in carbonizing coals over the whole range of swelling numbers, except in the case of certain special coals, which either give rise to excessive pressures on the chamber walls during carbonization or do not ultimately contract sufficiently to permit of easy discharge.

This extremely simple test can be safely regarded as the second essential test in any carbonization investigation—the first being the proximate analysis.

A second test which has proved of great value is the "Tube Test" originally developed by Koppers Co. of America, whereby it is possible to forecast accurately with 20 grammes of coal the yields of coke, gas, tar, ammonia, and benzole, as well as the calorific value of the gas on a large carbonization plant. This assay test on a very large number of coals from all over the world has enabled a number of interesting relationships between the various results to be established. For example, it has been found that the ratio of the thermal yield of debenzolized gas, obtained in the tube test, per ton of coal, to the percentage of volatile matter in the coal (*i.e.*, therms per unit of volatile matter) may range from 3.8 in the case of anthracite containing 8% of volatile matter to about 1.4 in the case of a lignite containing 50% volatile matter. It cannot, however, be over-emphasized that volatile matter, *per se*, is no guide to the gas-making quality of a coal. Again, it has been established that the percentage oxygen on the weight of coal which appears as H_2O, CO_2, and CO in the products of the tube test, taken in conjunction with the percentage of volatile matter, has a definite relationship with the therms of debenzolized gas per unit of volatiles. Thus a coal with 40% volatile matter on the dry ash free basis will yield 79.5 therms per ton of debenzolized gas if the coal contains 6% oxygen and only 67.5 therms if the coal contains 12% oxygen. A further fact is that the calorific value of gas from coals of high oxygen content and from coals of low volatile matter is low. High calorific value in association with high thermal yield is of importance, since it implies a high hydrocarbon enrichment value and a high yield of gas of a lower calorific value when steaming is practised.

Other important tests cover such subjects as rate of swelling, swelling pressure, prediction of coke quality, and nature of coal ash. But I have said enough to show that laboratory work correlated with practical experience has played and will continue to play a most important part in the evolution of carbonizing technique.

The main components of a carbonizing plant are the refractory materials, steelwork, and castings. During the past 30 years much research work has been carried out on these materials, with the result that their performance in use is much improved, with consequent reduction in maintenance costs. Acknowledgment should be paid to the work which has been done upon these matters by the various Research Associations set up under the D.S.I.R.

Dealing with the refractory materials, the standard specifications formulated by the Refractory Materials Joint Committee of The Institution of Gas Engineers have led to substantial improvement in the general quality of refractory materials available.

Experience has shown that careful laboratory control of refractory materials and jointing cements used in construction is essential, and, moreover, acts as a stimulus to manufacturers to maintain their quality, while at the same time encouraging the development of improvements.

Cast iron also plays a most important part in the carbonizing industries, and the work of the British Cast Iron Research Association in improving the mechanical and chemical properties of cast iron has been invaluable. Here, again, experience shows that the regular laboratory control of the quality of cast iron is most important and avoids many a failure in practice.

Selection of Carbonizing Plant

There are in use to-day many forms of carbonizing plant, and the question may well be asked: What is the best form of plant to adopt? My experience leads me to the definite view that there is no best form of plant. Each case requires separate examination. Generalizations are dangerous. It is as impossible to develop a standard carbonizing plant as it is to develop a standard formula for calculating cost of gas production. The suitability of plant for any particular case is dependent upon the consideration of a number of factors such as the type and grade of coal to be used, the calorific value of the gas to be made, the type of coke required, the market for tar, the size of the installation and the ground space available, the requirements as to local amenities, and the degree of flexibility required in operation.

The great increase in the use of gas for heating and industrial purposes has brought with it the need for flexibility in output of gas-making plant. The balance between production and consumption is attained by two means—first, gasholder capacity and, secondly, flexibility of output of the gas-making unit itself. Although constant conditions of operation of a modern high-temperature carbonizing plant lead to highest efficiency of performance and lowest maintenance cost, there are ways and means of providing the desired flexibility. With static forms of carbonizing plant—for example, horizontal retorts, and intermittent vertical chambers—a change in output is rapidly attained by the simple device of discharging the retorts and chambers as they become due and leaving them empty until required. By this means a reduction of 50% in output can be obtained in 6 hours or so. Combustion chamber temperatures of standing retorts must be checked. Full output can be regained in 12 hours, allowing for the necessary time to raise the heats.

With continuous vertical retorts, output of gas may be varied by a combination of factors. First, variation in coal throughput can be effected by altering the rate of coke extraction, the possible extent of this depending on the kind of coal being carbonized. Secondly, a careful arrangement of the retort scurfing cycle can often be made to fit in with week-end fluctuations in demand. Thirdly, with certain coals the procedure of "standing" the retorts has been adopted successfully on many works. But my main reason for introducing this matter of flexibility is to call attention to the possibilities of partial coal gas firing of settings, which provides a quick and satisfactory method of attaining flexibility on all types of carbonizing plant which employ step grate producers.

It has been found that up to 50% of the heating value of the fuel gas required for any setting can be supplied in the form of coal gas. This is best effected by introducing the gas through the front wall of the producer above the producer cleaning doors. The coal gas then makes its way through the red hot fuel bed, is cracked, and mixes with the hot producer gas. There is no difficulty in utilizing a proportion of coal gas in this way, and the method has the advantage that it provides a means for instantaneously reducing or increasing the make of gas from the retort house. If a plant is making 1 million cu.ft. of gas per day, and it is decided to turn over to partial coal gas firing, the reduction in output is immediately about 22%. Alternatively, if a plant already on partial coal-gas firing is making 1 million cu.ft. of gas, and it is decided to stop partial coal gas firing, the increase in output is immediately about 28%.

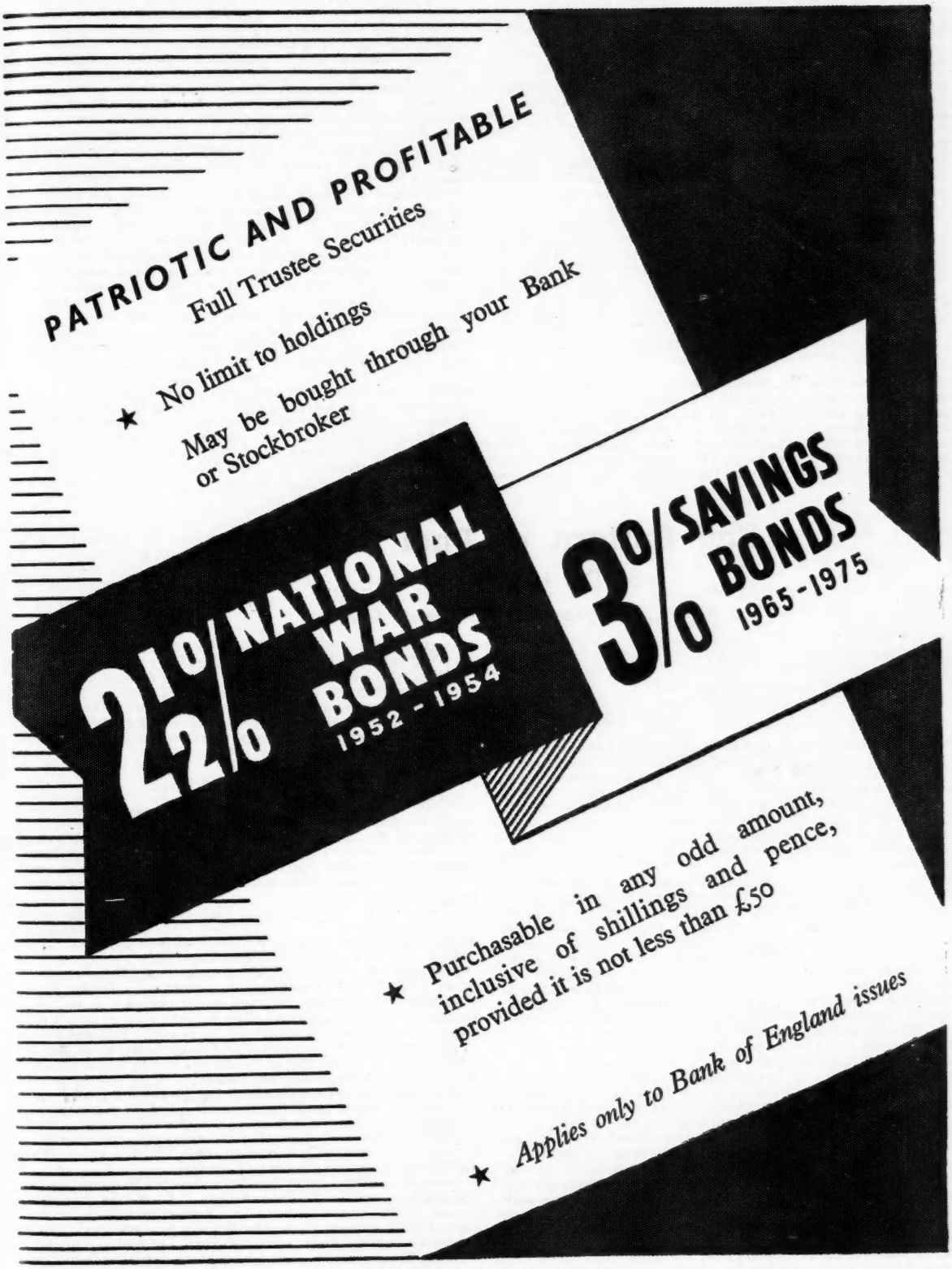
It must be emphasized that partial coal-gas firing up to 50% of the total fuel requirements of the setting introduces no operating difficulties. It involves the provision of a header main along the front of the producers, with provision for its distribution to the different producers, and to save purifier costs unpurified gas is employed. The present occasion is not one on which the economics can be discussed at length, but calculations show that taking coal at 30s. per ton and coke at 30s. per ton, the extra cost of partial coal-gas firing does not increase the retort house cost of gas by more than ½d. per therm of gas made. Of course, partial coal gas firing involves the use of more coal than is necessary per therm of gas sold, but in special instances, as, for example, a means of meeting the demand of some large user who requires gas for only a portion of each 24 hours, the method is simple and economical, especially if the holder capacity is limited.

The experience in this country is that the procedure generally employed in British gas-works of heating settings by hot producer-gas, coupled with waste heat recovery in the form of steam, leads, under British conditions, to a lower cost of gas made, in spite of the shorter life of the settings, than does the mechanical producer scheme which involves substantially higher capital charges. The Continental interest in the adoption of mechanical producers on gas-works has been largely influenced by the high ash content of many foreign coals, with the consequent difficulty of getting proper attention to producer fires of the step-grate type, and the fact that waste heat recovery has not been widely adopted in Continental gas-works.

The Impact of World Knowledge

In connexion with the part which the plant designer has played in improving the technique of the Gas Industry, I would like to draw attention to a fact which seems to me to need emphasis at the present time. In the period between 1918 and 1939 it became the established practice for each Great Power to develop and build its own gas-making plant and equipment. Marked progress was made in America, in France, and in Germany, as well as in Great Britain. Export of plant became extremely difficult to these countries. How then were we to get the advantage of their improvements? The method adopted was that reciprocal arrangements were made whereby our ideas and improvements were exchanged for theirs. Thus, through the contracting firms in this country the inventions of foreign development centres were made available to the British Gas Industry. I can speak with knowledge of many processes and plants now in operation in this country which have resulted from such arrangements. The exchange of information has been complete, and has saved us a great deal of costly experimental work.

For this process of "invisible exports" to be resumed in a postwar world it seems to me that there are two essentials—first, that technical development should be actively pursued in this country so that foreign countries will want to exchange their ideas with ours; secondly, that the procedure of providing an inventor with a limited monopoly by


PATRIOTIC AND PROFITABLE
Full Trustee Securities
★ No limit to holdings
May be bought through your Bank or Stockbroker
2½% NATIONAL WAR BONDS 1952 - 1954
3% SAVINGS BONDS 1965 - 1975
★ Purchasable in any odd amount, inclusive of shillings and pence, provided it is not less than £50
★ Applies only to Bank of England issues

Issued by the National Savings Committee

SPACE GIVEN BY THE WOODALL-DUCKHAM CO.
EPSOM ROAD, GUILDFORD. (Tel. GUILDFORD 3301)

means of patents should be maintained. Patents are the coin of exchange in such arrangements. Without patents inventions would tend to revert to the old procedure of "secret working," with the result that there would be a slowing up in the exchange of world information.

Coke

Recently there has been a good deal of controversy as to whether the Gas Industry should continue to produce coke, or whether it should adapt its manufacturing methods to the supply of gaseous fuel only.

The present position may be summarized as follows:

(1) In producing coke, the Gas Industry is placing at the disposal of the community bulk supplies of a solid smokeless fuel at a price which makes it, in many instances, the cheapest form of fuel to use.

(2) The credit for coke at the gas-works (after allowing for preparation, &c.) is sufficient to reduce the cost of coal per therm of gas by roughly one-half. It is a matter of simple arithmetic to show that the coke would have to be turned into gas with a yield at least twice that obtained at present per ton of coal if the cost of coal per therm is to remain at its present level.

(3) It has not yet been proved, in my opinion, that there is any practical process of doing this at a satisfactory cost which will give a gas similar in calorific value, specific gravity, and other characteristics to the town gas of to-day.

In face of these facts coke should be looked on as one of the most valuable assets of the Gas Industry. It seems certain that in the immediate future and for some time to come the Gas Industry must continue to pay more and more attention to the improvement of coke. Considerable progress in this direction has been already made. The technical issues involved were set out in detail in the various papers submitted in 1925 in connexion with the Coke Competition sponsored by the "Gas Journal." The London Counties Coke Association, by introducing standard coke grading, by seeking new outlets for coke and advising on the correct appliance to use, have given invaluable service to the Gas Industry. The necessity for low moisture and correct coke sizing cannot be stressed too much.

I wish, however, to draw attention to two factors which are not entirely in the hands of the Gas Industry, but which depend more on co-operation with the coal industry.

Low ash content and freedom from "bats" are absolutely necessary if coke is to be a satisfactory fuel. To ensure this, the Gas Industry in general prefers to buy screened coal and various sizes of screened nut coal. Hence, if the Gas Industry is to make the maximum contribution to the supply of smokeless solid fuel, supplies of clean gas-making coal at a reasonable price are essential.

Any system of rational use of our coal resources will have to take into account our dwindling resources of coking coal. It may become necessary for the Industry to accept a portion of their requirements in the form of the poorer coking coals. There is abundant evidence that a blend of good coking and poor coking coals can produce an improved coke, and the reason why blending is not more widely adopted in the Industry seems to reside in the cost of poor coking coals in relation to their reduced gas-making properties. If, therefore, the Industry is to take advantage of the improvement in coke quality and at the same time to make its contribution to the conservation of our resources of coking coal, it must be able to purchase poorer gas-making coals at a price which bears a relation to their gas-making qualities.

The future of the Industry depends first on the extent to which its technical men maintain its technical position, and, secondly, on the way in which the Industry as a whole, as distinct from the undertakings themselves, is administered. Great things are expected from the Committee of Enquiry set up by the Ministry of Fuel and Power, but whatever recommendations may be made it will still rest with the rank and file of the Industry—*viz.*, the Industry itself—to make the major contribution to its continued success.

The Pattern of Fuel Research*

By Dr. J. G. KING, O.B.E.,

Director of the Gas Research Board

" *Expatiate free o'er all this scene of man,*
A mighty maze! but not without a plan.

. . . . . .

Together let us beat this ample field,
Try what the open, what the covert yield."

Pope, "Essay on Man."

I HAVE chosen for my subject the organization of research on fuel problems, and have endeavoured to show that the groups of problems which constitute a research programme form a pattern, the study of which is of value in organizing a research effort to reach its objective in the most efficient way. It seems appropriate that the subject of fuel research should be reviewed this year, since it is just a quarter of a century since organized fuel research made a start in this country as a result of the initiative of that pioneer scientist, the late Sir George Beilby.

Since that time the extension of the field of research has been very great, and a complete review within the compass of one Paper would be quite impossible. I have therefore chosen three subjects within the field, all of them different in the type of organization which they require, to propound my thesis, of which, of course, this is only a summary. These three subjects lie within my own experience, and I have selected the illustrations I require mainly from researches with which I have been personally associated. These illustrations should show the varied methods which are used, how these are or should be connected together, and how the continual study of the pattern they form must help organized research.

In postulating the existence of a pattern, I am referring mainly to organized research, where plans of some sort must be made in advance. The pattern can in no sense be rigid, but should be subject to frequent review in order to eliminate unnecessary or unprofitable work, and to reassemble the research forces for direction against new objectives. There should be room in the pattern, however, for the work of the individualist, whose abilities will develop to the full only if he is allowed to work in his own way. His position will never be anomalous, however, since his discoveries may well, at a suitable stage, become team work, and thus take their place as part of the organized pattern. Finally, the existence of a pattern does not mean that all the work shall be done in one place or by one organization. On the contrary, if the pattern is there, it must serve as one means of promoting that true collaboration in research which alone will avoid the wastage of effort caused by undue overlapping.

[The subjects Dr. King chose to illustrate his conception were hydrogenation, the gasification of coal, and coal constitution. The first, he said, has led to important technical progress during the last fifteen years, and has extended into several fields. The second has advanced steadily during a period of over a century, and is perhaps on the eve of important developments. The third bears, in greater or less measure, upon all problems in which coal is a raw material or a fuel, but it retains many secrets yet to be told. In each case he indicated in the research patterns gaps wherein the research effort has not been applied sufficiently, and which should now be filled. We deal in this abstract with one subject only—the gasification of coal.]

* A *précis* extract of the Melchett Lecture to the Institute of Fuel, 1944.

Gasification of Coal

Taking the advances in the gasification of coal (I have limited myself to crude gas) for the production of town gas, these have until recently mainly taken the form of improvements upon the early-established process of retorting by external heat. The pattern of research has, therefore, been the comparatively simple one of a series of trials which gradually increased the efficiency of production over a period of years.

Now, however, that the use of high pressures in industrial gas reactions has advanced so far, and catalysis has become an important weapon, the pattern of research may undergo a change which may make it very different from its former simplicity.

Carbonization.—From 1920 onwards, a series of full-scale researches typical of this kind of investigation was carried out. The first of these was designed to examine the effect of steaming coal in continuous vertical retorts in an endeavour to increase the yield of gas above the previous level of about 76 therms per ton of coal. This was followed by a series of tests on coals typical of different areas, which gave data which have proved valuable in the control of retorts and the choice of coal, and probably also in retort design.

The planning of a research of this type is rather a special matter, and calls for careful control of conditions and the exclusion of all variables other than the one under examination. It also calls for specialized methods of observation and measurement, some of which form ancillary researches in themselves. It is, therefore, a very different matter from the simple collection of test data.

Examples of investigations in which a plant has been employed as a research instrument are (1) the evaluation of the effect of size and type of coal, (2) the increase of thermal yield of gas by cracking tar in the retort, (3) the increase in gas calorific value by cracking the vapours leaving the retorts. Since the rate of transfer of heat in coal and the nature of the plastic zone require more study, special interest attaches to a recent study of the zones which develop in continuous vertical retorts. This was made by "freezing" the contents of the retort suddenly while in full production. In a further research, the choice of coal for the manufacture of respirator carbon would have necessitated a tedious search without prior knowledge of coal properties, and of where coals having the required properties were to be found.

The same technique can be applied in the more ambitious project of designing a new form of gas retort.

Gasification.—The pattern in relation to gasification was, in the early stages, rather similar to that of carbonization in that it included a variety of researches using full-scale plant, but it had also a rather more fundamental approach in that there had been some study of the reactions involved.

I have illustrated the subject from researches on the production of water gas. In larger-scale work, the first stages were, as in carbonization, the standardizing of procedure to eliminate all the variables except the one under study. Since the production of water gas follows several cycles, and gas production is never at a uniform rate, the number of observations necessary for a full insight into the reactions is immensely greater. The first attempt at split-cycle analyses were made by multiple volume measurement, but an automatic method was soon evolved to avoid so tedious a method.

Careful observation of changes in gas composition and volume in these cycles was an obvious method of studying the gas reactions. The study was incomplete, however, without thermal data, and a convention was established to compare the thermal data of blow and run reactions separately in relation to the theoretical heats of reaction, and also to evaluate all those smaller thermal quantities which are difficult to measure, but which can confuse the issue by increasing the difference figure.

The consideration of such thermal balances is the only way to deduce those variations of cycle and of heat interchange which will lead to higher thermal efficiency. Control in the distribution of gas blow in the fuel bed, and therefore of temperature distribution, is important to good operation and output. A method of achieving this in part has been demonstrated, but the method should be elaborated. These methods can be applied with success during the operation of a plant under production conditions, and, since their value is unquestionable, it seems more than desirable that they should be extended to solve other problems.

Research on more fundamental lines can be exampled by the study of catalysts such as sodium carbonate on the water-gas reactions at atmospheric perssure, and the possible application of such catalysis to higher pressures and other temperatures. The use of X-ray diffraction methods has done something to explain the variation of reactivity of coke with structure, and has shown up interesting variations in the shape, size, and packing of graphite crystallites in cokes prepared from different substances, and at different temperatures. This technique may lead to a better understanding of factors which affect the strength and reactivity of cokes.

Reaction studies are stillin complete as regards carbon and oxygen and carbon and steam. A recent paper has indicated that the product of carbon-oxygen reactions is carbon monoxide, between 900° and 1,100°C., and that the reaction rate reaches a maximum about 1,200°C. This is the very range which is important in practice. The carbon-steam reactions must be explored in the same way.

New Developments in Gasification.—Recent developments in gasification are now indicating the growth of a very different pattern of research, which may require new techniques and a change in research personnel. These developments are concerned with the complete gasification of coal, which has hitherto been associated with gas of low calorific value, but now gives promise of a gas of normal calorific value. A successful process would provide, in operation with the established carbonization processes, a practical means of balancing the production of gas and coke.

One method involves the use of cheap oxygen and the gasification of coal with a steam-oxygen blast under a sufficient pressure, say 20 atmospheres, to promote the synthesis of methane from hydrogen and carbon monoxide.

A second method involves the operation of the above reaction at a high rate to produce a gas rich in hydrogen, and the use of this gas to gasify coal under pressure. At 50 atmospheres pressure, hydrogen reacts with semi-coke, synthesizing methane. The surface groupings of the coke are first attacked, but continued action disrupts the graphite crystallites until at 900°C. as much as 90% of the coke can be gasified to yield 60×10^6 B.Th.U. of gas having a calorific value of over 500 B.Th.U. per cu.ft. In the case of coal, enhanced yields of methane are obtained from the higher proportion of volatile matter while coking of the coal proceeds at a very high rate. If the reaction is interrupted at this point, the coke, which is highly reactive, can be used for the production of the necessary hydrogen by gasification with steam and oxygen under pressure. The exact balance between the two requires full-scale examination, but an overall yield of town gas of 250 therms per ton of coal is indicated.

A third method involves the production of methane by catalysis from mixtures of carbon monoxide and hydrogen (water gas). It has been found possible to purify water gas from sulphur compounds sufficiently to allow of the use of nickel as the methane-forming catalyst, and a catalyst has been found which, under carefully controlled conditions, will synthesize methane in equilibrium concentration for long periods at a high space velocity.

Still another type of research problem is introduced by the possible introduction of the use of oxygen into the Gas Industry, and by the possibility now presented of methane production for its separate use as a fuel. Liquefaction techniques must be evolved which will be suitable for (i) the production of oxygen at a sufficiently low cost, and (ii) the separation of methane in whole or in part from coal gas or synthesized gases.

These both involve difficult problems in physics and in heat transfer at low temperatures, which will require special study in order to determine whether the techniques can be applied successfully in the Gas Industry.

The reactions are strongly exothermic, and fundamental studies have been necessary to examine the effects of overheating upon the catalyst and the reactions promoted, and to find adequate methods of thermal control.

All three processes involve the physical study of gas reactions under a wide variety of conditions, and of the behaviour of catalysts under these conditions, the use of pressure, and the applications of the principles of heat transfer to the solution of problems in practice. The field of research on gasification is therefore changed to resemble in pattern that of hydrogenation.

The Pattern of Research on Gasification

I have considered the pattern of gasification research only as it applies to the production of crude gas. Apart from this, there is a wide field covering the subjects of gas purification and distribution and of by-products, and a still wider field dealing with problems of utilization of gas, coke, and other products.

The effect of scale upon the reactions which take place during carbonization is so great that one part of the pattern must continue to be research on plant operating under controlled conditions. Attention must be directed particularly to the conditions which influence the rate of heat transfer to coal. The effect of temperature upon the volatile products before they leave the high-temperature zone has been given some attention in coke-oven practice, and should be explored in gas-making also.

The modifications of choice of coal and of carbonizing conditions to produce cleaner and more reactive coke must also form an important part of the pattern in order that coke may become more flexible when burned in non-special appliances. The rate of heating of coal and the nature of the coke made are both influenced by the type of coal and by the degree to which it becomes plastic on heating and opposes the passage of gas or heat. Empirical methods have given some help in indicating practical solutions to the problems raised by this plasticity, but the attack must be made with much more determination, and must link coal constitution research and practical empiricism if this problem is to be solved.

The pattern of gasification research, like that of carbonization, has a section which contains those full-scale investigations on plant in which the effect of scale is a variable of over-riding importance. In the pattern also are those studies of gas reactions, their rates and equilibria in relation to working temperatures and conditions, which are complicated by practical questions of heat transfer. How large a part of the pattern this can be must depend upon the number of plants, with staff, which can be made available, but the work should keep pace with advances in knowledge which emerge from the fundamental study of the reactions. In addition, the latter must make provision for the examination of reaction kinetics and equilibria over a range covering the conditions of gas production.

In gasification problems, the "reactivity" of the coal and coke is an important factor, and a much larger part of the pattern should be devoted to the fundamental study of reactivity than has been given to it in the past. The study should follow the changes which occur in coke formation with a view to modifying conditions so as to produce the structure most marked by high activity. Recently the greatest insight into coke structure has been provided by the use of X-ray diffraction to define the variations in the dimensions of graphite crystallites. Extensions in this technique may help further if allied with practice. The electron microscope may also find useful application in this field.

Industrial oxygen has not so far assumed any part in the pattern, but it seems that it must do so. Research on the production of oxygen is not necessarily a part of the fuel problem, but its adaptation for gas-making purposes is.

The new systems of complete gasification proposed fall into a pattern similar to that of hydrogenation: reaction studies, catalysts, heat transfer, and particularly the implications of the introduction of pressure.

Conclusion

[From his review of the three fields of research, of which we have given a *précis* extract of one, Dr. King drew a general conclusion which, he feels, applies to all research.]

Dr. King said: Programmes of organized research appear to proceed in accordance with arrangements or patterns which differ appreciably according to the nature of the problem. These patterns consist in the arrangement of the sections into which the subject is subdivided in order to apply different methods of attack upon the problems. The pattern of a given programme may contain large-scale work, and problems arising thereform, fundamental research, and empirical and statistical work. I have concluded that the organization of research can be assisted by preparing the pattern with care, and the control of research by continued review of the pattern.

Time is one of the most important factors. It may be impossible or undesirable to prevent the progress in certain sections being faster than in others, but in any pattern the important precaution is to prevent the development of any one section from lagging behind to

such an extent that it either brings the others to a standstill or prevents due appreciation of their results as they appear.

Should the section to develop most slowly be that dealing with fundamentals, the remedy must lie in stricter limitation to the specific problem, or, since no single investigation of this type can be hurried, in the provision of more personnel. The immediate application of new methods is even more important.

Where the effect of variables in a process is concerned, and a large number must be explored, it is of greater importance to save time by multiplying experiments then to save personnel. A multiplicity of small units of apparatus may cost money and may require additional assistant staff, but neither outweighs the saving in time. This is particularly important where the total time of one experiment may be considerable, as, for example, in the evaluation of catalyst activity and life, and may apply even in large-scale work.

In empirical work, an increase of rate of progress in this way is not always possible, since each observation must be considered before the next experiment can be framed. Slowness in progress here can therefore be overcome only by close attention to results, and close correlation of these with the findings of the section dealing with fundamental work.

Certain branches of fuel research have separate patterns, but some part of these is, or should be, interwoven with the research patterns of others. The pattern of research on coal, for example, must link up with that of any process which uses coal as a raw material, and particularly if the process of treatment relates directly to the technique used in the research. Heat transfer provides a second example. The pattern of this research must cover all forms of transfer of heat, combustion and control of reaction heat, and it must link up with every kind of fuel research, not only in combustion problems, but in process work where the method of transfer is affected by the special properties of the material under treatment. A splendid lead has been given to fundamental research on heat transfer by Lander's team, but industrial research groups have so far been slow to apply the results.

Somewhere in the pattern of any organized research there must always be space for the individualist, whose discoveries of new facts or quick recognition of their application should act as a recurring stimulus to the advance of organized research. There can be no rule governing his position in the pattern, but he must be there. He may have no influence upon the pattern until something new is uncovered, but at that stage he may cause a drastic change in order that organized research may follow up his discovery with speed. The influence of inspiration and organized research upon one another is well illustrated by two examples from the work of Ludwig Mond, the father of the first Lord Melchett. His discovery of nickel carbonyl in 1897 took ten years of development to reach the stage of production, while "for seven arduous years he struggled with problems before he was able to claim that the ammonia-soda process was a success." The fundamental discovery was there in both cases: had the wider pattern of organized research now available been conceived then, it is possible that he would have reached his objective more quickly. It is indeed important that future research projects should be organized so that there may be the minimum wastage of valuable research effort.

Area Gas Supply

Discussion on a Paper to the Wales and Monmouthshire Association of Gas Engineers and Managers by W. Hodkinson and H. B. Taylor. See "JOURNAL," *October 4 and 11.*

(*Concluded from p. 508*)

Mr. **W. Clark Jackson** (Neath) said that like most other members he was deeply grateful to the Authors for such an excellent Paper. He had been seriously concerned for some time about the position of South Wales. Before the war South Wales was dependent on coal, steel, and tinplate. The coal position had deteriorated very largely; as regards steel they had a substantial position; tinplate had deteriorated very rapidly. The four essential features for industry were very well known; they were a suitable site, good road and railway facilities, cheap gas and electricity, and adequate supplies of water. There were many sites in South Wales that were good both from the point of view of position and in relation to road and railway. So far as coal was concerned he was of the opinion that they were dependent upon a national fuel policy. They had a Ministry of Fuel and Power, and there were possibilities if sufficient people would take sufficient interest and exert sufficient pressure to bring about a national fuel policy. The higher classes of steam coal ought to be allocated purely for export. The next best steam coals ought to be used widely for steam production in this country, and the lower qualities of steam coals and anthracite and coke ought to be compulsorily used in the open fires in the houses. That was a policy which they ought to see was brought about, particularly in South Wales, where the higher bituminous coals were scarce. They had a wealth of the better steam and anthracite coals. For the success of the Gas Industry there were four major features—namely, gas of regular quality, as mentioned in the Paper; service to consumers, of the value of which they were all aware; economic price, as emphasized in the Paper; and efficient administration at the back of all the other three. There would be a demand for gas, and they could improve the position in South Wales if they set about it in a satisfactory manner. There must be no selfishness attached to any schemes of this character. Whatever scheme was adopted must be available for the whole district; if it was not available for the whole district then it would fail badly. He had served on the Post-War Planning Committee since its inception, and he could see that there were so many walls to be got over that it would require a very radical move. In the present discussion he felt as technical men they were not tied in any way by their undertakings. They were there purely as a technical body, and if they felt convinced that a grid scheme was essential and would be the salvation of the Industry in that district and of benefit to the community generally, then they should say so without fear or favour. In his opinion if they were so convinced they should pass some resolution or take some step requesting their Post-War Planning Committee to consider immediately, and request the National Gas Council, of which their employing bodies were members, immediately to consider the question of a gas grid, with a view to requesting the Ministry of Fuel and Power to set up an enquiry in the district for the purpose of investigating the possibilities of the scheme as put forward in this very excellent Paper. There was no time for sitting back and wasting another 18 months. If they, as technical men, were convinced that this was a scheme of which they could approve they should press it strongly.

Mr. **Hodkinson** said it always appeared strange that they could never achieve any co-operation in their own Industry except when they were drifting. He recalled the trouble they had at one time with tar. Necessity was the mother of invention, and they formed their tar scheme, which, in the case of Lancashire and Yorkshire, resulted in 100% co-operation. He saw no reason why they should wait for Government control to run this scheme; he, at any rate, would be a very old man before it came about if they did. He believed sincerely that within their own Industry they were sufficiently strong to form co-operative schemes for the purpose of achieving area integration such as envisaged in the Paper. They were men of intelligence and knew what was urgently required; why not accept the challenge to their ingenuity?

Mr. **E. M. Edwards** (Secretary) said he believed a bulk system of gas distribution and centralized efficient modern carbonizing units were vital to the interests of the Gas Industry in South Wales and Monmouthshire, but he could not visualize any scheme approximating to that outlined in the Paper developing in the area until the Ministry had set up a committee to enquire into the scheme. He was perfectly satisfied that a scheme must mature, and he thought they might send a resolution to the Ministry saying that they, as a body of representatives of gas undertakings in South Wales, considered it was essential that an immediate investigation should be made into the economics and the advisability of a scheme of this character; not necessarily this scheme, but a scheme of the sort. Reference had been made in the Paper to the question of income tax allowance for obsolescence. If an undertaking simply bought gas in bulk without incurring capital expenditure he could not see how it could make a claim for obsolescence in respect of plant not used. If a works with £100,000 worth of plant came into a grid scheme its plant might become derelict, but it might put £100,000 into the grid, and claim that as a replacement of plant, and that expenditure would in fact become only £50,000.

Mr. **Hodkinson** said it was true that the basis of obsolescence at the present time would not permit the recovery of capital expenditure on the distribution mains if owned by an outside company. It would be possible, of course, for the company to claim obsolescence in respect of altered works connexions, control governors, meters, &c. He felt that if a major scheme of this nature, covering a very wide area, was carried out, it should be possible for the national bodies to negotiate with the Inland Revenue authorities for some variation in the law relating to obsolescence claims, whereby a company purchasing bulk supplies from an area distribution system and paying interest on capital which had replaced its carbonizing plant or other sections of its plant would be able to make a claim.

Mr. **H. B. Taylor** said it was important that the bulk distribution system should be under unified control. If each undertaking bought its own bit of mains and wanted to maintain and operate it there would be chaos.

Major **E. I. David** (Regional Gas Officer) expressed appreciation of the public spirit of the United Kingdom Gas Corporation in placing such data, so valuable as an asset of the company, at the disposal of that Association. He suggested that as gas engineers they were "passing the buck" to the coke oven people. In the whole of the country there were 12 areas. Only two had used coke oven gas to a greater extent than 50% of the total output; only four had used more than 25%; the remainder had used under 7%, and five had used no coke oven gas at all. The total use of coke oven gas in the country at present was only 12½% of the total gas manufactured, so that it was not a big item at the moment. The coke oven operators were dependent upon the market for foundry and blast furnace coke, and the sale of gas was a secondary business with them. They were not going to make gas just because the Gas Industry wanted it. It was possible that they might have a greater development of coke oven gas, but at the moment he thought they would be "passing the buck" to them. They should consider making gas themselves rather than be dependent on somebody else who had other and major interests. In

(*Continued on p. 547*)

Production of Sulphur Compounds during Carbonization in an Experimental Retort*

By C. L. EVANS, A.R.I.C.,

Central Laboratory, Birmingham Gas Department

WHEN your Council invited me to present a Paper to our Association, I felt that you might like to hear an account of some recent work in connexion with the problem of producing a sulphur-free gas. The work is far from complete and is being continued.

You are doubtless familiar with the numerous valuable reports and Papers submitted to The Institution of Gas Engineers and technical Press, and with the recent report of the American Gas Association. The Gas Industries of both countries recognize the urgent need for a really clean fuel—*i.e.*, sulphur-free. In common with most undertakings we in Birmingham have for many years been intensely interested in this problem.

One hears much more about devising methods for removing sulphur compounds, which are more or less accepted as unavoidable concomitants of normal coal carbonization, rather than methods for preventing or reducing their formation during gas manufacture. While actively pursuing work on the former, our attention was directed over 18 months ago to the latter aspect by the fluctuating, but frequently low, sulphur tests at one of our smaller works. A continuous series of short-period tests (2 to 3 hours) was made, and changes from 6 to 20 grains/100 cu.ft. were noticed within 24 hours on benzole-stripped coal gas. These changes were eventually found to be related to the coal carbonized. (Incidentally variations of this kind indicated the need for a sulphur recorder.)

As a result of the investigation on the works it was decided to test the organic sulphur-compound producing properties of our own coals under strictly comparable conditions, and to study the mechanism of sulphur-compound formation. It was thus hoped to find the possibilities, if any, of effecting a reduction of the formation of organic sulphur compounds during carbonization.

Production of Sulphur Compounds during Carbonization in an Experimental Retort with 30-lb. Charges

Our semi-scale coal evaluation plant proved eminently suitable for the work. It comprises a "stop-ended" retort in Cronite heat-resisting alloy, capable of carbonizing a 30-lb. charge of coal and complete with purification plant meters and holders. The retort is gas-heated fitted with thermo-couple points, and it is thus possible to control and vary carbonizing temperatures to within fine limits. Water condensation is provided, followed by a dilute acid washer for ammonia removal, and a similar washer through which dilute soda can be circulated for the removal of H_2S and incidentally CO_2. An aliquot portion of the purified gas make can, by geared meter, be directed to a 10 cu.ft. test holder.

The coals were crushed to below ½ in., charged into the retort previously heated to 900°C. The retort temperature was gradually raised to 1,000°C. over a period of 1½ hours, and maintained at 1,000°C. for a further hour, at the end of which gas-making had ceased. Sulphur balance determinations on the products resulting from carbonization of many of the coals tested were made. The following chemical tests were conducted:

(1) Sulphur in coal—total, organic, and pyritic—and total sulphur in coke (estimations by the British Standard methods).

(2) Sulphur present in gas (*a*) as H_2S—determined in the above-mentioned caustic soda wet purification liquor by gravimetric method.

(*b*) As organic sulphur compound—total sulphur, carbon oxysulphide, carbon bisulphide, and thiophene-determinations by method published in Institution of Gas Engineers' Communication 175.

(3) Sulphur present in liquor products (*a*) tar (by Mahler bomb), (*b*) liquor (gravimetrically).

In some tests, particularly those with high sulphur coals, 100% sulphur balances were not obtained; the majority, however, total 90–100% sulphur recovered in the products. Specimen balances are shown in Table I. Each coal was tested in duplicate. H_2S and sulphur in gas were determined on separate gas yields (the variations between duplicate determinations were less than 5%, which created confidence in the carbonizing technique). The tar, liquor, and coke sulphur contents were determined on combined tests.

TABLE I.

Coal.	Coke.	Pure gas.	H_2S.	Liquor.	Tar.	Total.
Low Sulphur, Yorks.	53·3	1·9	33·3	3.8	6.6	98.9
High Sulphur, Yorks. ...	65·5	2·8	21.6	0·7	3·3	93·9
Medium Sulphur, Durham ...	63·3	1.8	21.2	2.0	4·3	92.6
Low Sulphur, Warwicks. ...	57.0	1.5	21.2	2.4	6.1	88.2

These figures represent the percentage sulphur of the total coal sulphur appearing in the products.

* From a Paper to the Midland Junior Gas Association.

Our main interest, however, was the sulphur appearing in gas, and from tests on 46 gas-making coals the following conclusions were drawn: (1) With increasing sulphur content as a whole (range covering 0.71–2.75% total sulphur) the total organic sulphur appearing in the gas increased from 18 to 95 grains per 100 cu.ft., corresponding to 2,500–12,700 grains per ton ash-free-dry basis. The tendency is for sulphur in gas to increase with increasing coal sulphur, although anomalies occur.

(2) With increasing sulphur content of the coal the H_2S evolved increased from 25,000 to 112,000 grains per ton ash-free dry basis. Again irregularities will be observed, H_2S not being strictly related to the coal sulphur.

(3) No relationship appears to exist between the sulphur present in the gas as (*a*) organic sulphur and (*b*) H_2S; the H_2S/organic sulphur ratio varied from 25.4–6.9.

Effect of Coal Composition and Constitution on Organic Sulphur Components of Gas

On account of the more recent interest in COS—*i.e.*, the component of the organic sulphur in gas not removable by oil washing—COS determinations have been made on many of the gases obtained from these tests. Variations, in grains per 100 cu.ft., of 4–14 have been observed in gases produced from the Cronite retort. Further evidence of high COS concentrations—*i.e.*, in the order of 10 grains/100 cu.ft.—has been observed on coal gas produced from vertical retorts at our respective works. This fact was in contradiction to published results, and seemed worthy of further investigation. From the coal tests certain features were noted, and are shown in Table II.

TABLE II.

Coal type.	Total % Sulphur in coal.	Total organic Sulphur in gas.	COS in gas as Sulphur.	S/COS ratio.
		Grains per 100 cu.ft.		
Meta-lignitious ...	1.54	38	12.7	3.0
,, ...	0.71	18	7.8	2.4
,, ...	1.17	21	7.6	2.8
Bituminous	1.64	45	7·5	6.0
,, ...	2.38	82	11.8	6.9
,, ...	1.53	33	5·1	6.5
Cannel	2.38	94	11.4	8.2

It will be noticed that the meta-lignitious coals produce the higher COS in gas content relative to the organic sulphur. The ratio of the bituminous coals tested covers the range 5–7, whereas the meta-lignitious coals fall below 3. The yield of COS appears to rise with increasing sulphur content of the coal as shown by the result in Table III, obtained by "doctoring" a coal with pyrites to increase the sulphur content.

TABLE III.

	Coal. Sulphur %.	Coal. Organic Sulphur %.	Coal. Pyritic Sulphur %.	Total organic Sulphur in gas, grains, 100 cu.ft.	COS as Sulphur.
Coal alone	1.17	0.74	0.43	21	7.6
,, + Pyrites (*a*) ...	1.87	0.74	1.13	33	11.2
,, + Pyrites (*b*) ...	2.54	0.74	1.80	44	15.0
Coal alone	1.68	0.90	0.78	47	9.3
,, + Pyrites (*a*) ...	2.36	0.90	1.46	92	13.6
,, + Pyrites (*b*) ...	3.00	0.90	2.10	121	16.4

Effect of Carbonizing Temperature on Organic Sulphur Components of Gas

To further our knowledge of sulphur-in-gas origin, carbonizing tests were made at different temperatures. A bituminous coal of sulphur content 1.6% was selected for this series of tests (further coals have yet to be similarly tested). 30-lb. charges were made at temperatures 700°, 800° and 900°C. A retort was brought to the desired temperature and the coal charged. On recovery the retort temperature was maintained at the test temperature until gas-making ceased. Compared with standard test conditions 900°–1,000°C. the results are shown in Table IV.

TABLE IV.

Temps.	Total organic sulphur.	COS.	CS_2.	Mercaptans + thiophene.	HS_2.	H_2S/S.	S/COS.
700°C. ...	13.1	7.8	3.2	2.1	920	70	1.7
800° ...	22.6	9.7	8.3	4.6	684	30	2.3
900° ...	39.4	8.6	25.4	5.4	660	17	4.6
900°-1,000°	45.0	7.8	—	—	700	15.6	5.8

All results expressed in grains/100 cu.ft.

The COS yields at 700°, 800°, 900° and 900°–1,000°C. are respectively 630, 1,010, 1,030, 970 grains/ton, and it will be observed that at 800°C. and above the yields are approximately equal. The total organic sulphur in gas, substantially the CS_2, increases from 1,060 at 700° to 5,600 grains/ton. From this series of tests COS formation is thus a relatively low temperature product, CS_2 formation being favoured by the higher temperatures prevailing in the retort.

In an attempt to simulate temperature conditions in a continuous vertical retort, coal was charged at 800°C., maintained at that temperature until gas roduction ceased, the temperature of the charge then increased to 1,000°C., and further gas collected. The results compared with the standard test are shown in Table V.

TABLE V.

	Test: 800°C., then 800°-1,000°C. combined gas.		Test: Standard test 900-1,000°C.	
	Gr./100 cu.ft.	Gr./ton.	Gr./100 cu.ft.	Gr./ton.
Total organic sulphur ...	18.2	2,100	41.6	5,250
COS	8.2	940	7.3	920
Thermal yield, therms/ton	68.5		75.9	

Effect of "Steaming" on Organic Sulphur Components of Gas in Continuous Verticals

A comparison is given of the gaseous sulphur products obtained from the two coals carbonized in (*a*) the Cronite retort, and (*b*) one of our Test Works upwardly heated 6-ton per day vertical retorts. The Cronite retort tests are the standard 900°–1,000°C. tests, and were made on carefully taken coal samples from the consignment supplying the vertical retort. The vertical retort test was run for 3 to 4 days under test conditions, and continuous 8-hour gas samples were taken in a 10 cu.ft. test holder. Organic sulphur in gas determinations were made on these holder collections. H_2S was determined on the crude gas stream at outlet condensers. The results are shown in Table VI.

TABLE VI.

		(*a*) Cronite retort.	(*b*) Vertical retort.	(*a*) Cronite retort.	(*b*) Vertical retort.
Total organic Sulphur	Gr./100 cu.ft.	57	33	16	7
H_2S		607	700	285	300
COS		11.3	11.7	5.3	4.3
Total organic Sulphur	Gr./ton ...	7,560	4,716	2,280	1,360
H_2S		76,470	101,100	39,600	63,400
COS		1,500	1,647	740	840
H_2S/total org. Sulphur ...		10.1	21	17.8	47
S/COS		5.1	2.8	3.0	1.6
Conditions		900°-1,000° No steam	1,350°-1,050° 14% steam	900°-1,000° No steam	1,350°-1,050° 17% steam
Sulphur in coal		1.87%		0.72%	

The yield of organic sulphur compounds in grains/ton from the vertical retort test is lower than the Cronite yield. It is, however, similar proportionately to that obtained from the 2-stage carbonization experiment. The COS yield/ton is slightly increased by the COS from the water gas formed in the steaming zone. That the COS is not greatly increased is interesting, considering the increased CO present in the gas phase of the vertical retort giving increased chances for gaseous reaction. The experiments suggest that COS is substantially a primary product of coal carbonization, probably resulting from the decomposition of substances in the solid phase. The yield of COS is influenced by pyritic sulphur (maybe other forms) together with the oxygen in the coal. This COS-producing substance may not be initially present in the coal substance, but may result from the effect of heat on the coal.

Effect on Organic Sulphur Compounds in Gas of Added Substances to the Coal Charge

(1) *Pyrites* (obtained from coal of 83% FeS_2 content): In Table VII are shown the results obtained from the addition of pyrites to coals of different types prior to carbonization.

TABLE VII.

Coal	Sulphur content. %	Pyrites as Sulphur added. %	Na_2CO_3 added. %	Total organic Sulphur. Gr./100 cu.ft.	Organic Sulphur change. Gr./100 cu.ft.
Meta-lignitious ...	0.71	—	—	18	—
" ...	1.52	0.81	—	25	+7
" ...	1.17	—	—	21	—
" ...	1.87	0.70	—	33	+12
" ...	1.17	—	1.5	14	−7
Bituminous... ...	1.68	—	—	47	—
" ...	2.36	0.68	—	92	+45
" ...	1.68	—	1.5	25	−22
Cannel	1.04	—	—	31	—
"	1.88	0.84	—	75	+44

It will be noticed that sulphur addition in the form of pyrites does not add a constant amount to the organic sulphur in gas yield. The type of coal treated appears to have its effect, the lower rank coals being least affected. This may explain some of the anomalies encountered in testing our main coals, as shown in Table II. The possible effect of varying ash constituents and sulphur forms present in different rank coals has been examined, but as yet no evidence of their effect has been noticed. It is more likely that a study of the Stopes macro-constituents of the coal substance will throw more light on the sulphur in gas forming properties.

(2) *Sodium Carbonate*: In Table VII the effect of 1.5% of anhydrous sodium carbonate addition to the charge is shown in two cases. The results indicate an effect of the same order, although in these experiments the sulphur in gas is decreased. The effect of sodium carbonate on the components of the total organic sulphur formed in the gas has not yet been examined.

Conclusions

(1) Organic sulphur occurring in coal gas is not directly related to the total sulphur in the coal, although the tendency is for higher sulphur coal to produce higher sulphur-containing gas.

(2) It is difficult to associate H_2S with the formation of organic sulphur in view of the large variations obtained in the H_2S/total organic sulphur ratio.

(3) Rank of coal appears to have a great bearing on the organic sulphur components of the gas.

(*a*) The effect of added pyritic sulphur on the total organic sulphur in gas appears to be governed by the rank of coal treated.

(*b*) The COS component is a higher proportion of the total organic sulphur in gas from the metalignitious type coal than from the bituminous type.

(4) The COS component of the total organic sulphur is substantially a primary product of carbonization (little affected by "steaming" in verticals and temperatures above 800°C.). Its concentration in the gas varies with the coal carbonized—variations from 4–14 grains/100 cu.ft. with coals "as received" having been observed. The COS yield from metalignitious type coals is higher than from an equivalent sulphur-containing bituminous coal.

DISCUSSION

Mr. **F. J. Bengough** (President) called upon Mr. T. F. E. Rhead, of Birmingham.

Mr. **Rhead** said this type of experimental work was not easy to make clear. He considered that Mr. Evans had carried the work on sulphur in gas a definite stage further. As most of them would be aware, this was really a progress report, and he hoped that the Author would be able to give them further information on the subject later. The work done on COS marked a definite stage forward. It was shown to be a low temperature product, and most likely the primary product associated with certain changes in the coal substance effected by heat.

Mr. **C. S. Bentley** (Oxford) could not quite follow why tests were done on gas, liquor, and tar after adding pyrites.

Mr. **Evans** said the only specimen sulphur balance was in Table I, and those tests were on coals as received. But there were experiments where pyrites was added to the coal, the object being to see what effect the added sulphur had on sulphur in gas.

The idea in these particular experiments was to increase the sulphur content in coal to explore the relationship between sulphur in gas and sulphur in coal, because there were many anomalies which could not be explained. From the results of experiments made, they now believed it had something to do with the constitution of coal itself. The addition of pyrites did not add a constant amount of sulphur to the gas produced from coal so treated. One would have expected it to do so, but it did not. The pyrites addition to the meta-lignitious coal gave an increase of 7 grains to the organic sulphur in the gas, whereas on some kinds of bituminous coal a similar pyrites addition produced an addition of 45 grains, which explained some of the variations.

Mr. **J. A. Tomes** (Stourbridge) mentioned that at his works, as a result of washing vertical retort gas for benzole, they were able to reduce the sulphur content of town gas down to about 10 to 12 grains, but this was not sufficient, in his opinion, for domestic users' requirements. A point of great interest to them was the question of the cost, and he wondered if Mr. Evans could give him any figures as to the cost per 1,000 cu.ft. of gas relating to the plant of Henry Wiggin & Co.

Mr. **Evans** replied that the only figures he could quote were those of the Gas Light and Coke Company; this figure was about 0.13d. per therm.

Mr. **Tomes** remarked that when a room was heated by a gas fire only 50% of the energy of the gas was available, contrasted with some 90% obtained from flueless heating, which was equivalent to the reduction of the price of gas from 1s. 1½d. to 7½d. per therm. The great advantage of sulphur-free gas was, of course, the fact that no chimney or flue was required; and naturally in view of post-war tendencies in regard to housing construction, this was of great importance. Turning to the question of sulphur removal for industrial consumers, Mr. Tomes said that they were peculiarly situated at Stourbridge. The glass-works there experienced trouble from the sulphur in the town gas due to the formation of bloom, particularly as a result of the reheating of the ware in glory holes and the edge fusion processes. While they had reduced the sulphur to some 10 to 12 grains or so, the glass-works were providing for the removal of sulphur by the installation of a catalytic desulphurizing plant on their own works, so as to enable these processes to be carried out

without experiencing trouble from bloom. The Department had actually constructed at one works a small carbon desulphurizing plant which was quite efficient in operation, and was used successfully on edge fusion. It was in this respect that the cost figure would be most useful to them at Stourbridge. Mr. Tomes then asked what the prospects would be for any works in the Midlands with a load which consisted of some 50 to 60% for industrial purposes, none of which required a sulphur-free gas. It scarcely seemed fair to him to ask these consumers if they would be prepared to stand the increased price of gas by 0.73d. per therm which Mr. Evans had quoted, when they had no need of the sulphur-free product and there was only 30 to 40% of the total consumers likely to benefit by sulphur removal, and when quite possibly many of these users would not need or bother to take advantage of such gas. At the same time he was in full agreement that sulphur had to go, but he would like to hear what Mr. Evans' views were on this point, as it appeared to him to be a far bigger problem than most people thought.

Mr. **Evans** said that as yet the catalytic process for sulphur removal on the works was a costly process involving gas preheating within, or prior to, the catalyst chamber, gas cooling and further H_2S purification, and possibly additional boosters. He thought that if some catalyst could be devised which would function on crude gas, a great step would be achieved in reducing the cost of the process. But he had the feeling, in agreeing strongly with Mr. Tomes that sulphur must go, that the idea of small catalytic plants for industrial users was perhaps the best way of tackling the job. They were hoping to reduce sulphur in gas from the carbonizing angle, but they had not got very far as yet.

Mr. **Rhead** remarked that he did not think the impression should get abroad that they could deal with sulphur entirely from the carbonizing end. He thought that they would most probably have to rely on the catalyst method for dealing with much of the problem, but they could probably go some way towards reducing the work which the catalyst was called upon to do by reducing the amount and modifying the nature of the sulphur compounds produced during carbonization.

Mr. **D. A. Vince** (Dudley) suggested that the circulation of fairly large quantities of strong liquor in the retort house could have an influence on reducing sulphur.

Mr. **Evans** thought that Mr. Vince was possibly right in this direction. He said that quite recently in the *Journal of the Society of Chemical Industry* there appeared an article by Booth and Jolley dealing with the reduction of the sulphur content of gas by water treatment, in which it was stated that CS_2 and COS posessed practically the same solubility as CO_2. The method they proposed for the removal of the sulphur was water-washing under pressure; so that he thought that in their retort house procedure the circulation of large quantities of liquor possibly had some effect towards sulphur reduction.

Mr. **A. R. Myhill** (Birmingham) said he was interested in the table showing the relationship between sulphur in coal and in gas, and in the various anomalies which occurred; he took it that the figure given was the total sulphur in coal considered without any reference as to how the sulphur existed.

Mr. **Evans**: The total.

Mr. **Myhill** said he did not know how much sulphur existed in coal in the form of sulphates in ash, or whether these sulphates decomposed in such a way as to introduce sulphur into the gas, and to what extent. He wondered, regarding the anomalous results obtained by adding pyrites to coal, whether the amount of sulphur added to the gas by the pyrites was related in any way to the oxygen content of the coal. He asked whether any of the sulphur derived from the pyrites in any way tended, with the high oxygen of coals, to send sulphur into the ash rather than into the gas. He would like to see balance-sheets showing the distribution of the elements, sulphur, oxygen, carbon, &c., present before and after carbonization, with and without the addition of pyrites, in order to see what happened to this pyritic sulphur.

Mr. **Evans** said they had made an examination of the sulphur forms—*i.e.*, pyritic and organic—but could find no relationship between either of the two and the sulphur in gas. The sulphate content of coals examined was very low, and was disregarded. That the oxygen content of the coal had some effect on the organic sulphur appearing in the gas was shown. Analysis of the coal ash had not led to any explanation such as Mr. Myhill envisaged. At one time it had been thought that high alkaline ash constituents might cause a reduction in organic sulphur in the gas. The ashes from the two coals on which the addition of pyrites had such a dissimilar effect were alike in composition and low in calcium and magnesium oxides.

Mr. **E. T. Pickering** (Birmingham) said the Paper concerned work done during the past eighteen months or so. It was exacting work, and it was remarkable that Mr. Evans should have been able to embrace this wide field in the time. The work was incomplete, but he had provided them with some of the pieces of this complicated jig-saw puzzle of sulphur. In problems of this nature they had to make their pieces of the jig-saw problem before they could put the whole together, and they were not always sure that they had all the pieces to make a picture. Mr. Evans had mentioned that as evidence of carbonizing technique he obtained duplicate determinations in tests on coal for H_2S and sulphur in gas which were within 5% of each other. It was, he thought, a small figure, as it also included errors in analysis; and in case anybody misinterpreted the accuracy of carbonizing technique, duplicate thermal yields normally obtained agreed within ½%. It might be of interest to members that, while, as Mr. Rhead had indicated, they did not hold out much hopes of reducing sulphur compounds by anything except the catalyst process, they had considered what was possible by coal cleaning, and the Paper had provided an interesting sidelight there. In this particular work Mr. Evans had one of the fairly clean coals of small size hand picked into two portions—one dull coal (durain) and the other bright coal (clarain and vitrain). Although the ash content of the latter was only 0.5% its sulphur content was still as much as 1.2%. While, therefore, coal cleaning did in many instances greatly reduce the sulphur content of the coals, obviously this method could only take them a limited distance towards their objective.

Mr. **Bengough** asked whether the sulphur in gas, as represented by the range of 10 to 14 grains spoken of, gave a true picture; was it the total sulphur content? Had Mr. Evans done any experiments on different grades of gas? Recently the Industry had been interested in the subject of total gasification, and he sometimes thought that the sulphur content would be better expressed as per therm, instead of per cubic foot.

Mr. **Evans** replied that the accuracy of the sulphur in gas test was high, and he had no reason to believe that any sulphur compounds escaped unestimated from any test involving combustion of the gas. He had not had experience with sulphur contents on gases produced by total gasification other than water gas. Here, he remarked, the sulphur in gas appeared to vary, possibly as a result of varying sulphur content of coke. He agreed with Mr. Bengough that sulphur expressed in grains/therm was preferable to grains/100 cu.ft. He had used grains/ton for expressing results of carbonization experiments.

Mr. **Mawson** (Stourbridge) asked whether it was possible for sulphur to be in the coal in various forms, and thus cause these differences in results on the gas produced. Then, did the stocking of coal alter the constituents or the percentage of sulphur in coal? Delving into their stocks in the country, did not some of the older coal have the appearance of being pyritic?

Mr. **Evans** replied that, as previously indicated, the sulphur in coal did exist in different forms, but as yet no relationship between them separately and the organic sulphur in the gas could be established. Weathering of coal would tend to reduce the sulphur content by oxidation of the pyrites to sulphate, and subsequent leaching away of the soluble sulphate by water. He did not know why older coals should have the appearance of being pyritic.

Mr. **Cranmer** (Willenhall) remarked that Mr. Evans had mentioned that the total sulphur in gas was less with some continuous charges than in the case of a static charge. Could he say what particular constituents in the organic sulphur compound were affected by steaming? Did it affect all to the same extent, or reduce all in the same proportion, or any one particular constituent?

Mr. **Evans** replied that CS_2 appeared to be the component of the total organic sulphur most affected by vertical practice. As already stated, the COS component expressed as grains/ton was little altered. Thiophene similarly expressed was reduced. He emphasized the grains/ton rather than grains/100 cu.ft. mode of expression in comparing results.

Mr. **Rhead** enquired whether Mr. Evans could give his ideas as to the origin of organic sulphur in coal.

Mr. **Evans** confessed that he could no doubt argue with Mr. Pickering about this subject, but he did not feel justified in speaking at length by himself. But he did think that possibly it was due to bacterial action, and he doubted if the sulphur was there in the original substance from which coal was produced. Organic sulphur content of the coal varied pretty considerably, and he had met with increases from 0.7% to 1.3%.

Mr. **K. L. Pearce** (Senior Vice-President, Bilston), in proposing a vote of thanks to Mr. Evans, said it was an all-absorbing subject which had been receiving increasing attention in recent years. It was a matter of great satisfaction to them as a Junior Association that a progress report of this nature, carrying investigations on sulphur in gas a stage further, should be reported to them by one of their own members.

Mr. **L. W. Hathaway** (Wolverhampton), seconding, hoped that further progress would be made by Mr. Evans.

AREA GAS SUPPLY—continued from p. 544.

the South Wales area there were 13 coke oven installations, and of those only nine were producing coke at the present moment. Four were shut down, three permanently and one temporarily. Of the nine coke oven plants, eight were supplying gas to various distribution systems. They carbonized about 40,000 tons of coal and produced 400 million cu.ft. of gas, of which between 60 and 70 million cu.ft. went to gas undertakings for distribution. In that area about 4½ times as much coal was carbonized in coke ovens as in gas-making plant. Unfortunately South Wales was different from the West Yorkshire area in that the three major plants were associated with steel works, and only a small proportion of their gas—in the case of two of the works none at all, and in the third about 20%—was available for gas undertakings. At present there was little prospect of more gas from the existing ovens, but plans had been prepared, as they were aware, for two large coke oven installations, but these were entirely dependent on the sale of coke position, and therefore they

For every size of works and every class of coal...

WEST'S

CARBONIZING PLANTS

GLOVER-WEST VERTICALS

WESTVERTICAL CHAMBERS

440 carbonizing plants have been built or are under construction by West's in 24 countries. Working results from a wide variety of gas coals have established the high efficiency and adaptability of the West systems.

WEST'S

GAS IMPROVEMENT CO · LTD ·

MILES PLATTING MANCHESTER 10

TELEPHONE—COLLYHURST 2961-2-3-4-5 TELEGRAMS—STOKER MANCHESTER

LONDON OFFICE: COLUMBIA HOUSE, ALDWYCH, W.C.2 TELEPHONE: HOLBORN 4108-9 TELEGRAMS: WESGASCO ESTRAND

were waiting for a decision in which they would have no influence except by saying they would take their gas—a factor which might have some influence in the final settlement. It was only a partial influence; the influence which would settle the matter was whether there was a sale for foundry and blast furnace coke, and that was the general position in South Wales. The basic figure for gas in the calculations relating to the South Wales grid was to his mind a very low figure. He did not think there was any existing contract for gas at that price, or even close to it. On top of the basic figure there were certain distribution costs, which would vary considerably in different regions. There was a report published in 1930 which gave distribution costs at 1.79d. per 1,000 cu.ft. for existing load, reducing to 1.25d. for future load after considerable development. For the South Wales grid the figure for existing load was 8.6d., and for future load 6.2d. In the case of the West Yorkshire grid he was not quite clear how the figures of cost into holder were obtained, but it appeared from an earlier Paper by Mr. Hodkinson that the cost was 14.11d., while for Kippax the figure was given as 33.4d. He would like to know the reason for that discrepancy for figures in the same grid.

Mr. **Hodkinson** said they felt that the Gas Industry must be considered as a whole throughout the country, therefore their interests as the United Kingdom Gas Corporation holding some 50 gas undertakings were common with the interests of all gas undertakings throughout the country. If they had any information which they felt would be helpful or useful to the Industry it would be given to all. The strength of the Industry would always be measured by that of the weakest undertaking. Major David took the view that they based their ideas on coke oven gas. That was not their intention. They based their opinion on the possibilities of centralized production, be it in coke ovens, vertical or horizontal retorts, or whatever they had. Under present conditions with high prices for coke the economics fell in the direction of coke ovens. The Gas Industry was going to be a two-fuel Industry for many years to come, and that being so they had to bring a fresh vision to the problem of marketing coke. Coke had to be marketed and serviced equally with gas, and when that position was realized the Industry would be unassailable. They had a lot to learn from the coke oven operators in the production and marketing of coke, and he believed that co-operation between the two industries would be of mutual advantage. Major David had made some remarks about a Paper he had given to the Coke Oven Managers' Association in 1942. The reason for the difference in the figures to which he referred was that one of the undertakings was already taking coke oven gas before the scheme was introduced.

Mr. **Taylor** said the Gas Industry could operate coke ovens to make gas. They based their proposals on centralized works, whether with vertical retorts, coke ovens, or other plant for the bulk production of gas.

Dr. **E. W. Smith** suggested that instead of putting the matter to the National Gas Council, as Mr. Ablett had suggested, they should adopt a carefully drafted resolution and approach the major interests in the area. The industrial interests were primarily concerned in this matter, and they should get the backing of South Wales as a whole, which would have more effect with the Ministry than anything else. He was glad Mr. Hodkinson had pointed out that there was no intention of producing foundry or blast furnace coke. He did not think the domestic coke market could be met by making coke oven coke, which was nothing like as good as vertical retort coke for that purpose. The grid would have to be developed in an evolutionary way. They would take the most profitable area first, and proceed over a period of perhaps three or four years. A grid developed in that way would have fed into it at 100% maximum load all the gas that could be made available from existing large gas undertakings, and from the two large coke oven plants that were to be erected, in which there was going to be surplus gas. They would bargain with them and take the gas under contract. He thought it would be unwise if the Industry in South Wales were to be dependent on the conditions that existed in the colliery industry and the coke oven end of the colliery industry up to 100%, because whether they were friendly or co-operative or not their private interests had to be met. Then there would be breakdowns, and they had no control over breakdowns, and the percentage of gas they took over which they had no control should in his view never exceed 25% as a rough figure. The problem was divided into two categories if the very best was going to be done for the Gas Industry. The first was the grid, and the second was integration of all undertakings. With all the goodwill and co-operation in the world he did not think they would achieve proper control unless they had unity of control, and he did not think they would get that unless they had unity of finance. The municipal corporations had suggested large county undertakings. They knew his views on that. Think of an elected body in charge of technical and commercial concerns! Let them have specialist administrators and specialist engineers running the Gas Industry. Two things were necessary and equally important. One was regionalization. Regionalization meant unity of control within the region, and they could not get unity of control without unity of finance. Therefore, if he had his way, he would say to Colonel Carr, if you can get unity among the organizations, organize a co-operative system in South Wales limited in its profits just as any statutory undertaking is limited, and utilize the undertakings as they are to-day. There is no fear of anyone losing his job; get on with the job; get all the backing you can; get the support of the Ministry of Fuel and Power, and get their authority to do it. It needed one person to see a thing like that through, and he knew of no one better fitted for the job than Colonel Carr. If they could achieve regionalization along those lines he was certain it was going to be for the good of the Industry. He did not think such a grid as that outlined in the Paper depended necessarily on coke ovens. Stress had been laid on flexibility, and it was easy to get flexibility with continuous verticals.

Mr. **B. Bennison** (Coke Oven Managers' Association) said that when they came down to brass tacks and considered coke ovens as a possibility, if the Association cared to invite the Coke Oven Managers' Association they would like to discuss costs with them more closely than they had that day. He would not care to accept as very reliable the figures for South Wales. They might be all right for Yorkshire. If they could give any help they would be very pleased to do so.

On the proposition of Mr. **W. Clark Jackson**, seconded by Mr. **E. M. Edwards**, the following resolution was then passed: "That this meeting of the Wales and Monmouthshire Association of Gas Engineers and Managers resolves that the Post-War Planning Committee for South Wales and the South Wales District Executive Board of the National Gas Council be requested immediately to consider the convening of a meeting of all representative bodies of the Gas Industry in this area, to consider the submission of an application to the Ministry of Fuel and Power to set up at once a committee of enquiry upon the possible development of bulk gas making and transmission in the South Wales and Monmouthshire area."

On the motion of Mr. **R. S. Snelling** (Newport) the following resolution was also passed: "That this body is of the opinion that the Post-War Planning Committee should seek from the bodies forming it an addition to its terms of reference to the effect that it should seek to obtain for any grid scheme which may be put forward the support of industry generally in the district."

A vote of thanks was accorded to the Authors on the motion of Mr. **W. Clark Jackson,** seconded by Mr. **J. H. Canning** (Newport).

Model Kitchens at Hanley

With the object of bringing to the notice of the general public the contribution which gas can make towards labour-saving homes, the Stoke-on-Trent Gas Department has arranged for the erection of three modern kitchens in the main Showrooms at Hanley.

Whereas most examples of post-war planning have concentrated on houses which are yet to be built, this scheme is intended to cover also existing property, and the first kitchen, inspected recently by the Lord Mayor, the Lady Mayoress, and members of the Gas Committee, is designed to show how the kitchen in the larger type of house can be modernized and equipped. The size of the kitchen, 12 ft. by 12 ft., is larger than is likely to be incorporated in many of the houses which will be erected immediately after the war, but is typical of the space available in many existing houses.

The side to the left of the doorway is occupied entirely by a series of three cabinets, the end ones being 2 ft. wide, 1 ft. 6 in. deep, and 6 ft. 6 in. high internally, while the centre section is 4 ft. wide and the same depth and height as the other units. The first cabinet, which is fitted for drying and airing linen, comprises a lower section 5 ft. 3 in. in height, heated at the base and fitted with adjustable rails for carrying the linen, &c. The upper portion is designed for airing purposes, both drying and airing section being independently ventilated, and a portable ironing table is provided in the lower portion.

The central cabinet is fitted with slide-out work table with storage cupboards above and below. Between the sliding portion and the upper cupboards is an opening 1 ft. 3 in. high, thereby giving a clear working space if required 4 ft. long by 3 ft. wide, yet keeping the projection of the table into the room only 1 ft. 6 in. The other end cabinet is fitted with drawers in the lower half and cupboards above, the storage accommodation in this and the larger cabinet being approximately 46 cu.ft.

The opposite wall of the kitchen is fitted with built-in gas refrigerator on the left, white fireclay sink with combined drainer, and divided storage cupboard for vegetables, &c., and cleaning utensils below, and gas washing machine in a cabinet on the right of the sink. An additional teak draining board is fitted immediately over the refrigerator, and a coloured Vitrolite cover is fitted to the cabinet containing the washing machine. At each side of the sink above the refrigerator and washing machine china cupboards for dinner and tea ware are provided, the former with racks to support the plates. The other cabinet is centrally divided with a gas circulator fitted in the ventilated upper section of the right-hand half, with the result that the water heater is not a visible appliance and becomes an integral part of the scheme.

On the third side of the kitchen is an eye-level cooker on stand with rack below for pans, &c. Immediately above is a hood covering the whole width of the appliance with a perforated ventilator the full width of the hood, thereby ensuring perfect extraction of steam and products of combustion, and preventing downdraught affecting the oven. Alongside the cooker is a service which would be connected with the dining-room in a complete house.

With the exception of the circulator, which is chromium plated, all the gas equipment is in black and white enamel finish. The cabinets have been constructed by the Department's employees, and are designed to permit of simple rearrangement to suit practically any size of kitchen.